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THE MARINE MOLLUSKS AND BRACHIOPODS OF
MONTEREY BAY, CALIFORNIA, AND VICINITY

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COLLECTING ACTIVITIES

The first historical record of shell collecting in the Monterey region so far discovered is contained in Father Peña's account of the Perez expedition in the *Santiago* in 1774. Apparently shells from Monterey were in demand by the Indians of the northwest coast for inlay work and other purposes and explorers of that day, knowing this, supplied themselves with abalones and other Monterey shells for trade with them. The journal of Manuel Quimper of 1790 mentions shells traded to the Indians and Pantoja's account of the Eliza expedition in 1791 mentioned "Monterey shells" as being traded at various places along the coast. Caamaño's journal (1792) gives the clue that the shells most desired were black abalones. Concerning the villages on Graham Island, he writes:

The Indians wanted to exchange them (furs) for clothing, or shells, but the latter they desired to have of as green a color as those that some wore in great numbers hanging at their ears. We were surprised to see that several had those of a sort that is found only at Monterey, and even more surprised when they told us that we ought to arrange that in Spain the meat be not

extracted by heating the shells, as this process damaged the enamel, but that it should be done with a knife. I enquired who had taught them this, or had given them the Monterey shells, but either they did not catch my meaning, or I misunderstood their reply.

These facts and others from an interesting account by R. F. Heizer (1940) indicate that shell collecting at Monterey goes back at least one hundred and seventy years, perhaps even further.

For conchologists, the region of Monterey Bay has been a favorite collecting ground for more than a hundred years. Some of the characteristic shells of Monterey appear to have reached European collections soon after the beginning of the nineteenth century, probably through the trade then being carried on with Pacific Coast ports, especially in hides. By this means the following shells, well known for their beauty and for their abundance at Monterey, could easily have been and perhaps were actually obtained there:

Black Abalone, *Haliotis cracherodii* (Leach)—Zoological Miscellany, 1817.

Red Abalone, *Haliotis rufescens* (Swainson)—Bligh Catalogue, 1822.

Giant Key-Hole Limpet, *Megathura crenulata* (Sowerby)—Tankerville Catalogue, 1825.

California Olive-Shell, *Olivella biplicata* (Sowerby)—Tankerville Catalogue, 1825.

California Coffee-Bean Shell, *Trivia californiana* (Gray)—Zoological Journal, 1828.

It is not unlikely, also, that La Pérouse and Vancouver, both of whom visited Monterey in the course of their explorations, the former about 1787 and the latter in 1795, may have obtained some of the species described by early conchologists. Both of these expeditions were accompanied by naturalists.

Humboldt and Bonpland, though coming no nearer than Acapulco, obtained there in 1804 one species that seems exclusively Californian, the red abalone, probably brought down by some coastal ship.

It does not seem that Captain Beechey's exploration, from 1825 to 1828, obtained any shells at Monterey although many species common there were collected elsewhere.

The first authentic collections there were those of Professor Nuttall, in 1835, who discovered 70 of the more common land and sea-beach shells of California, of which 9 species were from Monterey, although some had already been described.

About 1838 the *Venus*, with Captain Abel du Petit Thouars, visited Monterey and obtained two or three new species besides several of Nuttall's. These were described by Deshayes and Valenciennes.

The surveying ship *Sulphur*, Captain Belcher, with the eminent conchologist Hinds, explored the west coast of North America from 1838 to 1842 but collected nothing new at Monterey although 21 species were discovered else-

where in California. Reeve, in his monumental *Conchologica Iconica*, quoted "*Fissurella Lincolni*, Gray," now known as *Diodora aspera* (Eschscholtz), from "Monterey, Belcher."

Another British surveying ship, the *Pandora*, Captain Kellett, followed much the same route in 1849 without taking anything new at Monterey. The same year Colonel Edward Jewett collected 45 new species in California, spending a week at Monterey, where he found two of them. Lieutenant Green, U.S.N., and Major Rich, U.S.A., also visited the Bay, where the latter found two out of his three new Californian species along with seven species that probably came from other localities.

The botanist Hartweg was in Monterey in 1855 and found a new species of chiton. Some time prior to 1860, A. S. Taylor sent four new species from Monterey to the Smithsonian Institution.

The records cited above are based on the reports to the British Association for the Advancement of Science by Dr. P. P. Carpenter in 1856 and 1863 on the mollusks of the West Coast, as reviewed by Dr. J. G. Cooper, who concludes that in 1860 there were 277 species of shells known from California, of which 66 were reported from Monterey, 22 being discovered there for the first time by six collectors.

In 1861, Dr. Cooper spent several weeks collecting on shore at Santa Cruz, Carmel, and Monterey, doing considerable dredging in Monterey Bay down to a depth of 40 fathoms and in Carmel Bay to 35 fathoms. He published a list of the shells collected, consisting of 272 species and subspecies of marine mollusks, and gave an interesting account of his work (Cooper, 1870a, 1870b). From Monterey only, Cooper found 197 species "excluding manifest varieties," which, with 50 others he collected at Santa Cruz only, brought the total collected in the Bay to 247.

During the next decade Cooper stated that collections made by Dall, Stearns, Newcomb, Canfield, and Harford brought the list of mollusks found to 316. In this period Cooper lived for a year at Santa Cruz and reported that he collected 107 species there during that time.

While the results of the work of four of the collectors mentioned by Cooper remain only in the shells they collected, some of which are still preserved in the United States National Museum and occasionally in other collections, William H. Dall, one of the country's foremost conchologists, has left us an account of his work at Monterey in 1866. While acting as Chief of the Scientific Corps of the Western Union Telegraph Expedition to Alaska in 1865-66, he obtained a three-week leave in January of the latter year, which he spent at Monterey. He was unable to do any dredging and, with the help of Dr. C. A. Canfield of Monterey, spent the entire time shore collecting. The results of his work were covered briefly in a note in the Proceedings of the California Academy of Sciences in which he stated that he himself had collected in two weeks

no less than 219 species, including 23 that were new or not previously reported from the region. He remarked that this number, added to the 44 already found at Monterey, but not collected by him, gave 263 as the number of species then known to have been found there (Dall, 1866). Later, he wrote: "I prepared at that time a faunal catalogue of the shells of Monterey, with notes and habitats, and on such species as appeared to be undescribed" (Dall, 1871), but his manuscript was never published. The new species Dall discovered, 17 in number, were finally described in the *American Journal of Conchology* along with others collected mostly in Alaska while he was with the Telegraph Expedition (Dall: 1871).

In the early 1890's Dr. Dall collected again at Monterey. While he published no special account of the results of his work then, he made the following interesting comment in a letter to Dr. H. A. Pilsbry, editor of *The Nautilus*: "Monterey as a collecting ground is already greatly injured, and will probably be nearly ruined before long, on account of the Hotel Del Monte, the new town of Pacific Grove, and the increased population of old Monterey, all the sewage of which is turned into the bay in front of the town. Beaches which formerly would afford several hundred species are now nearly bare, or offensive with stinking black mud. Old collectors will learn this with regret" (Dall, 1892).

The next published record of shell collecting in Monterey Bay is in 1893, when Williard M. Wood (1893) spent two weeks there and reported taking 91 species and subspecies. His list is interesting as it gives the numbers of each species collected and contains some unusual records in the light of present day collecting there. Like Dall, he bemoaned the fact that "Monterey is no longer the famous collecting ground it used to be. The increasing population at and around Pacific Grove is driving away all the land shells. The deadly sewerage flowing from the various towns into Monterey Bay is killing the marine shells."

In the summer of 1897, Dr. Harold Heath of the Stanford Marine Station (now the Hopkins Marine Biological Laboratory) collected a series of invertebrates and fishes for the Academy of Natural Sciences of Philadelphia, among which were a number of chitons. A list of 25 species and subspecies, including two new species, was published subsequently by Dr. Henry A. Pilsbry (1898) of the Academy, representing the most complete account of the group at the time.

In 1904, as part of a comprehensive plan for the study of marine biology by the United States Bureau of Fisheries, the steamer *Albatross* conducted dredging operations in Monterey Bay from May 10 to June 15. Hauls were made at a total of 128 collecting stations at depths varying from a few fathoms to nearly 1100 fathoms, data on which are listed in the report of the Bureau of Fisheries for the year 1905.

In addition to investigations of purely scientific interest, the work of the vessel included the development of a number of fishing banks hitherto only locally known. . . . A number of banks and ledges in Monterey Bay, all good rockfish (rock cod) grounds, were developed and charted. Off Point Santa Cruz is a small area called Rock Oyster Bank; an extensive rocky ledge, called Black Point Reef, extends entirely across the harbor of Santa Cruz; off Sauquel Point is a ledge called Sauquel Reef. About midway between Sauquel Cove and the mouth of the Pajaro River, parallel to the shore and about a mile distant, is a long narrow reef called Rock Cod Ledge; and off the mouth of the Estero Grande is a small spot similarly named. In the vicinity of Point Pinos are four fishing grounds much frequented by the boats from Monterey. Seventy Fathom Bank, or Coopers Rock, lies about 3.5 miles west of the Point; Italian Ledge, a smaller bank, is about the same distance north of the Point; Portuguese Ledge, still smaller, lies about 3 miles north-north-east of Point Pinos; and Humpback Rock, a tiny spot, is about 2 miles east of it.

The above quotation from the Report is of interest because the vicinity of localities good for fishing are, in our experience, usually also inhabited by a larger fauna than is to be found elsewhere, and are generally good places to dredge for shells and other marine life.

The work of the *Albatross* contributed vastly to our knowledge of the mollusks of the Bay, especially the deep-water species living in 100 to 1000 fathoms, which are impossible to obtain without special gear and equipment of considerable power. At least fifty species, about twenty-five of them new, were added to the list from the Bay based on a study of *Albatross* dredgings by Dall and Bartsch, who published their results from time to time in the Proceedings of the United States National Museum.

Dr. S. S. Berry of Redlands, California, did considerable collecting in the vicinity of Monterey and Pacific Grove and made a series of dredge hauls, mostly in shallow water, over a six weeks' period in 1906. His list, published later in *The Nautilus* (Berry: 1907 and 1908), is a valuable addition to the mollusk-fauna of the Bay as it contains many records of species not previously reported. In addition, he added 14 new species and 2 new subspecies. Berry stated that he collected 318 species and varieties (including land and fresh-water as well as marine). In his account he quite properly calls particular attention to the extraordinary development of the chitons (26 species and 4 subspecies); of *Epitonium* (9 species); of the Pyramidellidae (18 species); and of the prominence of the limpets in the shore fauna, both in number of species (15) and of individuals.

The senior author began collecting in Monterey Bay and its environs in the summer of 1910 under the expert tutelage of Professor Josiah Keep, of Mills College, who for a number of years had come to Pacific Grove to deliver a series of talks on conchology in connection with the Chautauqua assemblies held there. His audiences consisted largely of local collectors, a scattering of scientists in other fields, and a number

of young people who were attracted perhaps not so much because of the subject and the enjoyable field trips, but more because of the man himself and his unusual ability to infect all who came in contact with him with his seemingly inexhaustible store of knowledge and boundless enthusiasm for the broad field of natural history, particularly in conchology. His shock of white hair, his ruddy complexion, and his booming laugh are well remembered by all who were fortunate enough to attend his classes during the period. In all probability he accomplished more in developing a knowledge and appreciation of the remarkable marine-shell fauna of Monterey Bay than any other individual. His books on West Coast shells are full of references to the shells of the region. Less well known, however, is the list he printed privately for his later Chautauqua classes containing 97 of the commoner species of the Bay (Keep, 1910).

One of the molluscan groups for which Monterey Bay is a center consists of the sea-slugs, or nudibranchs, of which there are many species. Cooper listed only 4 genera and 4 species in 1871, but in 1906 Dr. F. M. MacFarland of Stanford University increased this to 16 genera and 20 species in a paper devoted to an account of these beautiful animals (MacFarland, 1906).

The next scientific paper of any extensiveness on the mollusk-fauna of the Monterey region is a study by G. E. McGinitie (1935) on the ecological aspects of Elkhorn Slough in which a careful analysis was made, among other biological groups, of the marine shells of this locality. This completes the principal written records to the present date.

The junior author began collecting in the Bay in 1920, and has continued his work there ever since. More concentrated effort was made in 1932 while stationed at the Hopkins Marine Biological Laboratory.

Many others have collected extensively in the Bay and although the results of their work is unpublished they have added many new records of species as a result of careful work over many years. While it is impracticable to name them all, the efforts of the late Mrs. Charles S. Fackenthal, Mrs. David Muir, M. J. Becker, Miss Isabel Thayer, and Mrs. Bernard Freeman, all of Pacific Grove, among the older collectors are especially worthy of mention. The contemporary collectors who have done considerable work in Monterey Bay include Mr. Andrew Sorensen and the Rev. Elwood B. Hunter of Pacific Grove, Mr. and Mrs. Emery P. Chace of Lomita, Mr. and Mrs. Harry Turver, and Tom and John Q. Burch of Los Angeles.

While shore collecting is undoubtedly far from what it must have been in the days of Dall, Canfield, and Cooper, it is still a good collecting area if one knows where to go. Gone, however, are the windrows of shells from many of the favorite beaches, which have long since been cleaned of the better and rarer specimens by collectors and the frequent summer visitors who come for a day or a vacation at the seashore. No longer is it possible to collect two hundred species in two weeks, as Dall did in 1866. Even at ex-

tremely low tide the rocky shores are less productive, as many of the movable rocks have been overturned in the ever-increasing search for specimens of marine life. In recent years the more spectacular species, such as the red abalone, the owl limpet *Lottia gigantea* (Sowerby), the giant key-hole limpet *Megathura crenulata* (Sowerby), the red top-shell *Astraea inaequalis* (Martyn), and the horn-mouth *Purpura foliata* (Martyn), to mention a few, have become increasingly scarcer.

Shore areas where one is free to collect without restriction are much fewer. Prohibited spots now cover some of the best former collecting ground along the rocky coast. Among these is a two-mile stretch of coastline from Pacific Grove to Point Pinos, which has been wisely set aside by the city authorities as a marine-life refuge where collecting is prohibited. Another extends along the ocean front of the Monterey Peninsula, where access to the rocky shores is restricted by the private estates along the famous 17-Mile Drive. The Point Lobos area, now a State park, is another wild-life area closed to collecting. While there are still long stretches of rocky coast from Carmel to Point Sur and below that afford good collecting in favorable spots, there are a few good places in the more sheltered areas of Monterey and Carmel Bays that are unrestricted and where the conchologist can operate without special permission.

Dredging is probably still about as good as formerly, although in shallow water near the end of Monterey Bay one is liable to find a foul bottom where cannery and other refuse have killed all the marine life that was once there in abundance.

Off-shore kelp beds, a splendid harbor for top-shells (*Calliostoma* and *Tegula*), have disappeared from many areas off Pacific Grove and Del Monte Beach, where they were once thick. Carmel Bay, however, still has a heavy growth of kelp off shore.

While restrictions and changed conditions place definite limitations on shell collecting in the Monterey region it is to be hoped that a closing of certain areas will result in a return of the finest species to the size and numbers of former years. Apparently, this is already proving to be true of the black abalone on the rock ledges of Point Lobos.

PHYSIOGRAPHIC FEATURES AND MOLLUSK FAUNAS

The area considered in this paper extends from Pigeon Point south to Point Sur, a distance of approximately fifty-five miles, airline. The shoreline distance, which would follow all the irregularities and indentations of the coast, is more than a hundred miles. Monterey Bay itself covers an area of about 130 square miles. In the comparatively small area under consideration, almost all of the better-known types of shore and submarine ecologic conditions common to the temperate West Coast are encountered.

The rocky open seacoast condition of the littoral zone is typified by conglomerate and other resistant sedimentary rocks exposed in the vicinity of Point Lobos, a few miles south of Carmel, and by the porphyritic granite of the Monterey Peninsula between Pescadero Point and Point Pinos. Here, in tidepools, nestling in rock crevices, or clinging to various species of algae are found about one hundred species of marine mollusks, chiefly gastropods and chitons. The porphyritic granite that crops out at Carmelo Point and between Point Pinos and Monterey is partly sheltered from the open sea, which permits a coarse-grained granitic sand to collect in pockets among the kelp-covered rocks and boulders. The fauna in this habitat totals almost one hundred and eighty species of mollusks, including most of those found along the rocky coast together with a number of small gastropod species that nestle under boulders set in the sand and a few pelecypod species that live in the sand itself.

Strata of soft Miocene shale crop out in the vicinity of Santa Cruz Point and other strata of Pliocene sandstone are exposed near Capitola. These rocks harbor a number of rock-boring pelecypods as well as other mollusks—a total of not quite eighty species.

The open beach condition is represented by Carmel Beach, with its famed white sand, and by small sandy beaches between Cypress Point and Point Joe on the Monterey Peninsula. Only five species, all of them pelecypods, manage to thrive in these wave-swept stretches, though numerous mollusks inhabit the rocky points between them. From Monterey to Watsonville extends a long unbroken sandy beach, somewhat protected from the direct buffeting of the open sea. The sand of this beach varies in coarseness and patches of gravel are exposed locally, at low tide. About fifteen species of mollusks, most of them pelecypods, comprise the normal littoral fauna.

The last of the various ecologic types of the littoral zone, the typical estuarine condition, is encountered in Elkhorn Slough. Approximately thirty-five species of mollusks, the majority of them pelecypods, inhabit the fine sand and mud. Some live in interesting commensal relationships with prawns, worms, and other mud-flat denizens. The Slough is noted for the abundance of individuals of the species living in it.

Intimately associated with the littoral fauna of the rocky coast, but constituting a separate sub-littoral faunal group is the giant kelp assemblage, which includes about one hundred and forty-five mollusks and one brachiopod. The habitat of these species centers around the giant kelp plants growing at depths of from one to five fathoms. Some of the mollusks cling to the kelp stems, others nestle in the protecting mazes of the holdfasts, and still others live in the coarse sand and on the boulders to which the holdfasts are attached.

The bottom of the shallower part of the neritic zone of Monterey Bay, from five to forty fathoms in depth, consists of fine dark sand with locally

scattered fragments of shale or other rocks. From this type of bottom four species of brachiopods and about two hundred and twenty of mollusks, many of them gastropods, have been collected.

Strata of Miocene shale form submarine reefs in eight to twelve fathoms off Del Monte, and at Humpback Rock in about forty fathoms off Pacific Grove. Other reefs in ten to fifteen fathoms off Watsonville, Soquel Point, and Santa Cruz are of Pliocene sandstone, some of it fossiliferous. Clinging to, boring into, and nestling among these rocks are about ninety-five species of mollusks, in addition to most of the sand-dwelling forms encountered around the fringes of the reefs. These are the most prolific collecting stations in the Bay, with almost three hundred species recorded from them.

At depths of from thirty to one hundred and fifty fathoms the fine sand that is common in the shallower parts of the Bay grades into mud, and harbors a small but interesting fauna of about sixty molluscan species. In parts of this deeper neritic zone, between forty and one hundred fathoms, are large areas of gravel and clay. The presence of rock and gravel generally adds four brachiopods and twenty mollusks to the above-mentioned muddy bottom fauna. The gravel beds in the southern part of the Bay are favorite fishing grounds, especially in the neighborhood of Italian Ledge and Portuguese Ledge, which are sedimentary reefs lying in fifty to sixty fathoms about three or four miles in a general northerly direction from Point Pinos.

The Monterey Submarine Canyon is a distinctive and remarkable physiographic feature of the Bay. Its head lies in seventy fathoms about three-quarters of a mile west of Moss Landing and it extends in a general westerly direction. It is narrow-walled at first but opens out to a width of three and a half miles in a distance of about eight miles, where the bottom depth is four hundred fathoms. Beyond this point the Canyon takes a southerly direction and opens out rapidly into the Monterey Sea Valley with the maximum depth dropping to a thousand fathoms or more. The edges of the Canyon are at a depth of about seventy fathoms, and of the Sea Valley west of Point Pinos and Cypress Point, about a hundred fathoms. The hundred-fathom line west of Cypress Point is only a mile off shore and the depth increases to nearly seven hundred fathoms four miles or so off the Point.

A similar but less extensive submarine canyon is Carmel Canyon, whose head lies two-fifths of a mile off the mouth of the Carmel River, and which expands irregularly with the depth dropping to three hundred and fifty fathoms three miles or so off shore. Carmel Canyon has not been as well explored as Monterey Canyon and consequently little is known of its mollusk fauna below twenty-five fathoms. The side-walls of both canyons have been reported to have many jagged pinnacles of hard rock.

The occurrence of these two submarine canyons in the Monterey region adds a bathyal zone to the marine ecologic conditions already described.

The fauna of this zone in Monterey Bay includes about fifty-five reported species of mollusks on a fine sand or mud bottom, and seven mollusks and four brachiopods where the bottom is rock or gravel.

In addition to the bottom dwellers at least eight pelagic species of mollusks and fifteen free-swimming cephalopod species are to be found in the Monterey region.

For additional information on the shore conditions around Monterey Bay the reader will find much of interest in Ricketts and Calvin's "Between Pacific Tides," published in 1939. An account of the bottom conditions in the Bay is given by Galliher (1932). Another study, by Bigelow and Leslie (1928), covers the temperature, salinity, and chemical content of the ocean water of the Bay, and also the availability of microscopic fauna and flora for food. For the hydrography of the Bay, reference may be made to the work of Skogsberg (1936). A list of the marine algae has been published recently by Smith (1944).

COMMERCIAL USE OF MOLLUSKS FROM MONTEREY BAY AND VICINITY

THE RED ABALONE

One striking feature of the mollusk-fauna of the Monterey region is the fact that it contains six of the eight major species of abalone described from the West Coast. Of these, the red abalone *Haliotis rufescens* Swainson is of great commercial importance because of its excellence when well prepared and served as steaks, in chowder, or as the basic ingredient for other delectable fish dishes. In fact, it is not at all unusual in California restaurants to find that one has been served abalone cut to the right shape instead of the "eastern scallops" that were ordered. Nor is this such a flagrant substitution, as the flavor of the two is close and defies detection by all except the expert. Species other than the red abalone are of no commercial value. The meat of the black abalone is of inferior quality, while the others are small in size, rare, and found usually in relatively deep water.

The red abalone fishery in California is an old one and the vicinity of Monterey has been one of its principal centers for many years. The Chinese carried on the industry, beginning as early as 1864 to dry the meats for shipment to China. In this, they were joined by the Japanese, but of late, with operations shifting to deeper and deeper water, the Japanese until the second World War dominated the industry by use of the most modern diving equipment.

The first legal restrictions on the taking of abalones for commercial purposes was reported by Stearns (1899), when he stated that the supervisors of Monterey and of other seaboard counties had taken the necessary steps to

regulate the "fishery." The Monterey County ordinance restricted "fishing" for abalones, except in deep water and set a license fee of \$60 to be paid by commercial operators.

The drying of abalones was stopped by State law in 1915 and the good-sized drying camp located within the city limits of Monterey was closed. However, the canning of abalones, which had started about 1905 at Cayucos, in San Luis Obispo County, was carried on for many years near Point Lobos on the south side of Carmel Bay. This cannery shut down operations in 1928 and there has since been no canning of abalones in California.

For a more detailed discussion of abalone diving operations and the economic status of the red species the reader should refer to two interesting papers by Paul Bonnot (1930, 1940), of the California Division of Fish and Game. He has stated that the present fishery extends along the coast line between Point Pinos and Point Buchon, south of Morro Bay in San Luis Obispo County, approximately one hundred and twenty-five miles in length.

After making a series of thirty-four dives in 1939 at depths varying from twenty to one hundred feet, Bonnot said:

Abalones are found on rocky bottoms from the low tide line to an undetermined depth. There are vast numbers of them out to the 60-foot level. From 60 to 80 feet there is a gradual decrease in numbers and at 100 feet only a few are found in unusually favorable places, a condition which is said to continue to greater depths. The divers ordinarily work out to 80 feet. Only occasionally do they endeavor to work at greater depths. From the shore line to the 80-foot level in the territory surveyed, there are great numbers of abalones with shells that measure 6 to 8 inches in diameter. Comparatively few are 8 inches or larger (8 inches is the legal minimum size limit). This is a logical sequence in territory systematically worked by the divers.

There are a few 5-inch and still fewer 4-inch abalones, and below 4 inches none at all, except in one or two areas where special conditions prevail. The absence of the small sizes constitutes a serious condition. As the 6- and 7-inch abalones reach 8 inches and are taken by the divers, there will be no younger age classes to replace them.

In 1918, the commercial catch for the entire State was only about three thousand dozen, but with the rise in popularity of the abalone as a sea-food, the catch increased to 56,350 dozen in 1927 and over 41,300 dozen in 1928. This latter figure represents more than 2,066,000 pounds, or over one thousand tons of abalones. The commercial catch of California boats landing abalones at Monterey during the ten-year period 1931-1940 is shown in the accompanying table, indicating a steady decline in the catch reported for each year since 1934. In addition, of course, there is the non-commercial catch, which must run to considerable proportions each year judging from the number of people who flock to good hunting grounds during the exceptionally low or "abalone" tides.

LANDINGS OF FRESH MOLLUSKS FROM CALIFORNIA BOATS
REGION 50, MONTEREY

Pigeon Point, south to Point Piedras Blancas

Year	Abalone	Pismo Clam	Gaper Clam	Cockle	Clam (Misc.)	Calif. Mussel	Oyster Native	Oyster Eastern	Oyster Jap.	Squid	Octopus
1931	3,210,825	16,510	60	—	—	150	—	—	—	1,706,671	58,412
1932	2,135,375	25,157	—	54	16	—	9,142	—	—	4,087,621	17,554
1933	2,221,500	26,097	—	—	—	—	—	—	78,088	769,695	22,535
1934	2,786,775	19,198	—	—	—	—	—	—	50,240	1,486,446	18,938
1935	2,656,200	23,425	—	—	—	—	2,250	67,630	—	783,102	53,362
1936	1,575,675	20,289	—	—	—	750	—	—	9,226	933,231	48,721
1937	1,433,200	14,087	—	—	—	1,490	—	—	—	464,739	19,160
1938	1,203,950	20,110	—	7	800	150	—	—	—	1,472,003	24,423
1939	789,450	16,330	36	—	—	—	—	—	—	1,097,815	23,225
1940	813,400	13,524	—	—	—	100	—	—	—	1,644,122	17,591

Data from reports and papers published by the California Division of Fish and Game. All figures in pounds.

While the decline in the catch of the red abalone may not be a particularly serious matter in view of the existing supply of shells just under the legal limit, the rarity of young to medium-sized shells might spell tragedy for the fishery in the long run. The situation is particularly unfortunate because of the lack of adequate knowledge of the life history of the red abalone — especially with respect to breeding habits. No natural resource can be “managed” successfully unless the laws that regulate it are based on sound scientific information. It is to be hoped, therefore, that the fact-finding survey of the State Division of Fish and Game will be continued and also that a comprehensive study of the red abalone will be undertaken by individuals or institutions properly equipped for the task.

SQUID

The commercial fishery in Monterey Bay is an interesting one and ranks as one of the most important in the Bay. This is due, in recent years, to an increased demand for dried squid for export to China as food, the establishment of canning operations for squid, and the creation of a small demand for fresh squid in the fish markets. To most people the idea of eating squid may be abhorrent, yet when well prepared and fried in pure olive oil it is said to be on a par with abalone steak or fried scallops. The species taken in the Bay is *Loligo opalescens* Berry.

There are two brief but informative accounts of the Monterey squid fishery by W. L. Scofield (1924) and Classic (1929). According to the former writer:

The squid industry along our coast is one of the most interesting, one of the oldest, and probably the least known of our California fisheries. The Chinese at Monterey fished for squid years before sardine canning was thought of, even before salmon were caught in large commercial quantities and the old Chinatown on China Point near Monterey was a busy community that polluted the atmosphere for miles around with the odor of drying squid, an odor that yields the palm for potency only to a whaling station. In the days before the power boat and before the Mediter-

reanean lateen sail was a common sight on Monterey Bay, most of the fishing was carried on by Chinese in small junks rigged with the ribbed sails of China or sculled by a single long sweep. Before 1870 the Chinese had established a town on China Point and were catching and drying squid. Later on the lights from their floating bonfires on dark nights were a common sight off the south shores of Monterey Bay.

Squid are now caught with lampara nets mostly at night in the same manner as sardines. A few may be taken throughout the year but the spring months of April, May, and June are considered to be the squid season. The commercial catch is variable, as the figures in the table show. Not shown, however, is the high year of 1930, when a total of nearly 11,000,000 pounds was landed at the Monterey Wharf.

Eighty per cent of the squid used to be dried in open fields, baled, and shipped for export. However, no squid have been dried at Monterey or elsewhere in California since 1932, and those who still hold memories of the spot known as "Heliotrope Point" in the Monterey of former years are quite willing to allow their experiences with drying squid to remain buried in the dim past.

Phillips (1941) has pointed out that drying was stopped because of the unstable condition of Chinese foreign exchange, coupled with the competition caused by a low-priced product from Japan. He stated that:

Although fresh squid are sold in the domestic markets, the quantity absorbed through this channel is not great because these sales are mainly to people of a few nationalities who cultivated a taste for this cosmopolitan mollusk in the land of their birth. A great deal of the fresh squid is frozen for shipment to retail markets throughout California. During the spring of 1941, large quantities of fresh squid were also frozen in five-gallon liver cans and shipped as bait to shark fishermen working out of Santa Barbara and Port Hueneme, California.

Canning of squid in California is of minor importance. The average amount taken annually for canning during the period 1918-1940, inclusive, was approximately 50,000 pounds, and this includes two years when no squid were canned. During the last three years there has been a great increase in the amounts canned, reaching a peak of 935,000 pounds in 1940. Most of the recent pack has been produced by one Monterey cannery.

At present, squid is canned "natural style," that is, squid in its own ink. It is also canned in sesame oil with the ink absent. The cooked squid "has a mild, shrimp-like flavor," says Phillips. The bulk of the canned product has been exported.

Since August, 1935, another species of squid, the Jumbo Squid *Dosidicus gigas* (d'Orbigny), has been taken in and off Monterey Bay in great numbers although it was a rarity in the Bay prior to that date. In November, 1935, a thousand pounds were landed at Santa Cruz by a "drag-boat" working in one hundred and ten fathoms. Set-line fishermen also reported taking them in depths as great as three hundred fathoms on hooks baited for sable-fish. Since then many have been seen occasionally swimming on the surface, sometimes close to shore.

The Jumbo Squid ranges from two to four feet in length and may weigh from five to thirty pounds. Richard S. Croker (1937) of the State Fisheries Laboratory remarked that no one has yet devised a way to make it palatable, when prepared for the table, and hence a commercial fishery for this species has not been developed. (See also Clark & Phillips, 1936). According to Croker:

In 1936 they seemed to be even more abundant all the way from Monterey Bay to San Diego. It was in this year that they were first recognized as a nuisance by the fishermen. Albacore trollers were first bothered with them striking at the jigs. Usually the squid pulled loose, but they invariably left some of their tender anatomy on the hooks to foul them. Those that were caught squirted slippery, insoluble ink on the decks much to the disgust of the fishermen. Rockfish set-liners complained bitterly that the squid not only stole all the bait from their lines, but also damaged the fish that had been caught on the hooks.

The plague of Jumbo Squid has been worse in 1937. Setline, net and troll commercial fishermen are still bothered with them, and in addition sport fishermen have been harassed all spring. No sooner does a pleasure boat start to fish than a horde of squid appears on the scene to crowd the game fish away and seize all the baits. When one is hooked, it proceeds to shower boat and fisherman with ink and water, and then delights in biting its captor with its parrot-like beak. Several fishermen have been seriously bitten this year. Although squid fishing is hilarious sport for a few minutes, it becomes too much of a good thing day after day.

Latest reports indicate that the Jumbo Squid is still a nuisance in the Bay.

OCTOPUS

It may be news to some that California has a thriving "devilfish" or octopus fishery of commercial proportions although of minor importance. Since 1920 the annual catch for the State has varied from 10,000 pounds to 165,000 pounds, with an average of about 75,000 pounds, of which eighty-five per cent is landed at Monterey and Santa Cruz.

At Monterey and at other points along the California coast, octopi are captured in baited traps consisting either of a wire-screened box or a peculiar dome-shaped basket of wicker or rattan, reinforced with wires. There are two and sometimes four octopus fishermen at Monterey, all Italians, each using from ten to thirty of these traps. The men anchor their traps one-half to one mile off the open rocky shore between Point Pinos and Carmel, in from ten to thirty fathoms of water. The normal season for fishing is the spring, summer, and fall months, a set of ten traps producing an average of fifteen octopi a week. Monterey specimens generally run from twenty-five to thirty pounds in weight but there is a record of an individual that weighed ninety pounds. The form caught is *Octopus* sp., cf. *O. apollyon* Berry, although sometimes listed as *O. hongkongensis* Hoyle.

Japanese abalone divers, working as deep as one hundred feet along the coast where octopi are trapped for market, do not complain of attacks by this

eight-armed cephalopod. On the contrary, an occasional one is cornered by a diver, who ties a line around its body so that it can be lifted to the surface, later to provide the main course of a meal.

Octopi are eaten in all of the fishing ports along the California coast, mostly by Italians. They do not ship well, so are not transported to any great distances.

For an excellent account of this small but unusual fishery on which information in the above paragraphs are based the authors are indebted to J. B. Phillips (1924).

OYSTERS — Native and Introduced

While there is no active oyster industry in Monterey Bay at present, attempts have been made to establish one in the past. The possibilities for development are limited to Elkhorn Slough, as this locality is about the only one in the Bay that is suitable for oyster propagation. The Slough consists of two long narrow channels that unite about half a mile from the ocean water of the Bay. The main arm is about six miles long and varies in width from fifty to one hundred yards. The Slough is open to the Bay at all times and is therefore subject to tidal flow.

Speaking of the oyster industry, Bonnot (1935) had the following to say:

Because of its accessibility and freedom from pollution, the slough has been used for oyster experimentation for some years. Native oysters are indigenous. In 1923 small eastern oysters from Texas were planted but they gradually died out or disappeared. In 1929 Mexican oysters were tried but they also failed to survive. Japanese oysters were introduced in 1929 and as they showed up well, 243 boxes of Japanese seed, set on tarred rope, were put out the following year. The rope was handled after a method developed in Japan, by cutting it into short lengths and hanging it from rafts. From this plant of 243 boxes some 9000 gallons of oyster meat was harvested and sold. The growth of these oysters was remarkable, requiring only eight months from the time of planting to reach market size. By the next spring the few oysters that remained were too large for the market, which calls for an oyster of 200 count (200 to the gallon).

Twenty-five barrels of Eastern oysters were planted in January, 1932. Some were laid out on the bottom and some were strung on copper wire and hung from floats. They have shown a good growth but have not equaled the Japanese in size. Experiments have been carried on for the past two summers at Elkhorn in an endeavor to obtain a local race of the Japanese oyster, but so far without success. Other experiments, however, have resulted in a heavy set of native oysters, and with a little attention the slough should be able to produce a good grade of native oysters in fair quantity.

From 1933 to 1936 good quantities of Japanese oysters were harvested but for several years none have been marketed. Small numbers of both the native and Eastern oysters were harvested in 1935 only. The oyster industry in Elkhorn Slough is not active at present.

The planting of oysters that are not indigenous to Monterey Bay should be watched carefully to prevent, if possible, the introduction of other species of mollusks that are harmful to them. The oyster drill *Urosalpinx cinereus* (Say) is already found in the Slough but so far the Japanese drill *Ocenebra japonica* (Dunker) has not been reported. Several other species have been introduced with oysters elsewhere in the State and in the bays and harbors of the Pacific Northwest. Shell collectors should therefore be on the lookout for new species liable to have been introduced into the Bay and report them, when found, to the proper authorities, particularly the Bureau of Marine Fisheries of the State Division of Fish and Game. For an excellent account of introduced species of mollusks the reader is referred to a paper by Dr. G. Dallas Hanna (1939) of the California Academy of Sciences, published by the State Department of Agriculture.

Eastern oysters planted in Elkhorn Slough were *Ostrea virginica* Gmelin, those from Texas probably being a variety of this same species. The species introduced from Mexico is likely to have been *O. chilensis* Philippi. The Japanese species is *O. laperouseii* Schrenck but is referred to by some as *O. gigas* Lamarck. The species native to the Bay is the well-known Olympia oyster *Ostrea lurida* Carpenter.

CLAMS AND MUSSELS

Although many species of clams found in Monterey Bay are edible, with only two or three exceptions they are not taken in commercial quantities. One is the Pismo clam *Tivela stultorum* (Mawe), which is found in small numbers at Moss Landing and at Watsonville Beach. Although J. G. Cooper reported the Pismo clam as common at Santa Cruz in 1861, it does not appear to be taken there in any numbers at the present time. During the legal season Pismo clams may be bought in the markets at Monterey, Watsonville, and Santa Cruz, and along the highway between these cities, for ten or fifteen cents apiece. The preceding table shows the reported annual commercial catches for a ten-year period.

Unlike the red abalone, the Pismo clam has been carefully studied and its life-history is now well known (Weymouth, 1923). Steps were taken to protect the species after the great beds of them at Pismo Beach were virtually exhausted. Under present laws for a closed season during the breeding months and bag limits that control the number and size that may be taken, the species might have been expected to begin to rehabilitate itself where once it was common. Unfortunately this has not been sufficient even to maintain the species and the outlook for the industry, at least at Pismo, is not bright.

At Pismo a census is taken every year by the State Bureau of Marine Fisheries that gives information on the size of the previous year's "set," and the numbers of clams of spawning age and legal size. There have been only three good sets in the last fifteen years, one of which, in 1937, suffered an

unusually high mortality. The clams reach legal size in about five years and then begin to be removed quickly. As a result of poor sets and other reasons it seems likely that the Pismo clam will have to be placed on the protected list for a number of years in order to give the species an opportunity to multiply to the point where there will be an ample supply in Monterey Bay and at beaches farther to the south. There is probably no hope that even under the most careful management there will ever be numbers comparable to those encountered in "the good old days" at Pismo, of which it has been said that the farmers could go down to the beach during a low tide with a horse and plow and turn clams out by the thousands.

The Pismo clam is one of the West Coast's finest species, which, for its combined qualities of size, tenderness and flavor, has few equals.

Other species of clams occasionally taken in Monterey Bay are the "gaper" or "rubberneck" clam *Schizothaerus nuttallii* (Conrad) and the cockle or little-neck *Protothaca staminea* (Conrad). Although the "geoduck" of Puget Sound and northern bays has been collected in limited numbers in Morro and San Pedro Bays, it appears to be quite rare in Monterey Bay, occasional specimens having been reported as taken in Elkhorn Slough.

The common California or sea mussel *Mytilus californianus* Conrad is also taken occasionally for the market, as the table shows.

All of the above species, and those in the following list, may often find their way to the tables of individual epicures, although the total catch is probably small:

<i>Cardium nuttallii</i> Conrad	Giant cockle
<i>Macoma nasuta</i> (Conrad)	Bent-nosed clam
<i>Macoma secta</i> (Conrad)	Butter clam
<i>Mya arenaria</i> Linnaeus	Eastern soft-shelled clam
<i>Platyodon cancellatus</i> (Conrad)	Rock clam
<i>Saxidomus nuttalli</i> Conrad	Giant clam; Washington clam
<i>Solen sicarius</i> Gould	Jack-knife clam
<i>Zirfaea pilsbryi</i> Lowe	Mud-borer clam

SHELLFISH POISONING

Although the species of clams and mussels from the Monterey region listed above are edible under normal circumstances, a word of caution should be interjected, for there are times when clams, and mussels especially, make dangerous eating because of poison they absorb at certain times along the California coast. For a brief account of this situation we are indebted to Dr. G. Dallas Hanna, who was instrumental in assembling the following information:

Since 1927 periodic cases of poisoning from eating the mussel, *Mytilus californianus*, have been reported along the west coast from southeast Alaska southward as far as La Jolla, California. Results are serious, as very severe illness and often death follow. Thus in June, 1939, the newspapers reported thirty-two cases and three deaths from eating these mollusks collected at Monterey, in spite of the fact that

the gathering of them at that time was strictly prohibited and all likely places had been posted with conspicuous signs.

A great deal of study has been given to this problem by members of the staff of the Hooper Medical Foundation of the University of California. Many papers have been published, references to which, together with a late summary of the results obtained, will be found in the two referred to below. (Sommer, Whedon, Kofoid, and Stobler: 1937; Sommer and Meyer, *et al.*; 1937.)

A few of the noteworthy points determined are:

1. The specific poisons are derived by the mussels from dinoflagellates belonging to the genus *Gonyaulax* and probably to the species *catenella*.

2. While *Mytilus californianus* has been responsible for most of the ill effects to human beings the toxic poison has been found in many other bivalve mollusks and even the common sand crab, *Emerita analoga*.

3. The following species have been selected from the papers referred to because dangerous amounts of poison were found in them.

Mytilus californianus Conrad—General distribution.

Saxidomus nuttalli Conrad—Washington.

Schizothaerus nuttallii (Conrad)—Bodega and Tomales Bays.

Siliqua patula (Dixon)—Half Moon Bay.

Protothaca staminea (Conrad)—Bodega and Tomales Bays.

Pholadidea penita (Conrad)—Half Moon Bay.

Tivela stultorum (Mawe)—Monterey Bay.

Macoma (species?)—Bodega Bay.

Volsella demissa (Dillwyn)—San Rafael, San Francisco Bay.

Probably this list will be extended with further study.

4. Except in the case of the single *Volsella demissa*, the mollusks of inner bays such as San Francisco have thus far been free from dangerous amounts of poison. Apparently the inhabitants of open surf-swept shores are the most susceptible.

5. Several poisons appear to be involved, the exact chemical structure having been determined for none of them as yet.

To this account we can add but one item, which relates the possible connection between the presence of phosphorescent "red water" off the coast and epidemics of shellfish poisoning (Bonnot and Phillips: 1938).

Fortunately, the California Division of Fish and Game is on the watch for any signs of this trouble and notices are posted and appear in the press whenever there is danger. At these times the epicure should, for his own protection, withhold his natural and perfectly understandable desires for a dish of his favorite shellfish, and wait for a more favorable time.

A list of references on shellfish poisoning, which is as complete as we have been able to obtain, is given on pages 242 and 243.

CHECKLIST OF SPECIES

In assembling the accompanying checklist of the mollusks and brachiopods of Monterey and its vicinity the attempt has been made to gather every authentic record, especially from the Bay itself. Besides searching all available literature, shells from many of the museums and private collections on

the West Coast have been examined. The junior author has made an intensive search through the United States National Museum Collection at Washington, D. C., and determined the status of many questionable records for species listed by Dall in his "Summary of the Marine Shellbearing Mollusks of the Northwest Coast of America, from San Diego to the Polar Sea . . .," published by the National Museum in 1921.

The large collection at the California Academy has provided the source of many hitherto unpublished records. This includes the Hemphill Collection and a number of others acquired subsequently, including that of the junior author. In addition, the fine collection at Stanford University, which includes the Oldroyd Collection, the collection at the University of California at Berkeley, and a number of private collections have been carefully reviewed.

Because it has been necessary to exercise a degree of judgment in accepting some of the older published records and eliminating others, the present list is far from being the last word. Much careful collection needs to be done in order to confirm or reject the right of many species to remain in it, and perhaps to add new ones yet unreported. Also, inevitable taxonomic changes will result in adding, combining, or eliminating species.

The checklist follows, in general, the classification used by Dall in his "Summary," except that his emphasis on subgeneric names has not been applied. In certain other instances we have deviated from Dall's work for reasons that are believed to be sound. No attempt has been made to supply the latest view on taxonomy but where changes have been made the authorities on which they are based will be found listed under the heading "Synonymic Notes," beginning on a subsequent page.

In citing species names we have tried to adhere strictly to Article 23 of the International Rules of Zoological Nomenclature by placing parentheses around authors' names when the species are classified under different genera from those originally used. Because of the many taxonomic changes that have been made, there is a question whether this procedure still serves any useful purpose.

Records that are patently erroneous or that appear to be doubtful are shown in brackets ([]) in the list. Many of these belong to a fauna farther to the south in California or Lower California and we have not been able to confirm the fact that they really belong to the fauna of the Monterey region.

Species described from specimens originally collected in the area are preceded with an asterisk (*). To these, we are adding 18 new species and subspecies, which are described and figured on subsequent pages. It is notable that about 27 per cent of the valid species in the list have Monterey Bay or its vicinity as the type locality, the total being 197.

As the relative abundance of individuals of a species, the range in depth within which a species normally may be found, and the conditions or nature

of its habitat are important essentials in a checklist, we have given careful attention to these three items. While this information for each species represents our knowledge at the present time, we would be the first to point out that it is still far from accurate or complete for a great many of them, especially those living in the deeper parts of the Bay and the surrounding ocean.

In order to show relative occurrence of a species in point of numbers we have used a five-step scale, based on the occurrence of individuals *within the known habitat*, as follows:

<i>Occurrence</i>	<i>Definition</i>
1. Abundant	A species of which individuals may be found everywhere in large numbers. The collector can take an almost unlimited number of specimens, if he so desires, at any time when the tide is right or when dredging at the proper depths on the proper type of bottom.
2. Common	Individuals occur in considerable numbers and can be collected usually in fair quantity under the right conditions. A collector could expect to find specimens of a common species easily without making a special search.
3. Fairly Common	Species of which individuals may normally be taken in small numbers. A collector could expect to find a few specimens of a fairly common species each time he sought for it.
4. Scarce	Individuals occur occasionally, and then singly or only a few at a time. The collector could not expect to find specimens of a scarce species every time he collected, nor would it come up in every dredge haul.
5. Rare	Species of which only a few specimens are known to have been collected. A number of species listed as rare are based on a single shell.

Species shown as rare may, in some instances, prove to be scarce or even common when more is learned of their habitats, or, if they live in deep water, when more opportunity and better facilities for dredging for them is afforded. The exact number of specimens existing for a rare species is given in the checklist, if known.

The checklist contains 732 species and subspecies considered valid, which are classified under 139 families and 305 genera. Also listed are 80 more considered doubtful or erroneous. This is truly a remarkable assemblage of

mollusks and brachiopods from a north latitude of 36°. The following table gives a breakdown of the total, by groups:

Group	Numbers of Species and Subspecies		
	Valid	Doubtful	Total
Pelecypods	189	22	211
Scaphopods	10	0	10
Gastropods			
Pteropods	5	0	5
Opisthobranchs	21	2	23
Nudibranchs	36	0	36
Pulmonates	5	0	5
Ctenobranchs	393	44	437
Chitons	51	9	60
Cephalopods	15	1	16
Brachiopods	7	2	9
	732	80	812
TOTAL			

We know of no other locality outside of tropical or semitropical areas where the molluscan fauna has such a large number of species. The fact that the ranges of nearly a hundred additional species not yet authentically reported from the Monterey region extend both to the north and to the south of it indicates the possibility of adding these to the list, bringing the total to over 800 species and subspecies.

Genera having the largest representation of species and subspecies are shown in the following table, which lists those having six or more:

Genus	Number	Genus	Number
<i>Turbonilla</i>	30	<i>Margarites</i>	8
<i>Odostomia</i>	27	<i>Balcis</i>	8
<i>Acmaea</i>	16	<i>Nuculana</i>	7
<i>Epitonium</i>	14	<i>Pecten</i>	7
<i>Ischnochiton</i>	14	<i>Colus</i>	7
<i>Cerithiopsis</i>	11	<i>Propebela</i>	7
<i>Bittium</i>	11	<i>Pholadidea</i>	6
<i>Macoma</i>	10	<i>Dentalium</i>	6
<i>Ocenebra</i>	10	<i>Mangelia</i>	6
<i>Alvania</i>	10	<i>Nassarius</i>	6
<i>Mitrella</i>	9	<i>Amphissa</i>	6
<i>Mopalia</i>	9	<i>Boreotrophon</i>	6
<i>Calliostoma</i>	8	<i>Haliotis</i>	6

The authors will be grateful for any additions or for further information that will serve to make the checklist more complete and accurate.

In acknowledging our debt to those who have assisted us in the prepara-

tion of this paper, it should be mentioned that experts on various molluscan groups have been of very material help. Dr. F. M. MacFarland of Stanford University furnished the list of nudibranchs and supplied much information on the habitats and occurrence of many species in this group to which he has given special study for many years. Dr. S. Stillman Berry reviewed the lists of his specialties, the chitons and cephalopods. Mrs. Avery R. (Grant) Test of the University of Michigan furnished collecting records and notes on the taxonomy of the limpets. Dr. Paul Bartsch reviewed the turrids and has kindly published the descriptions of several new species from the Monterey region so they could be listed here, in advance of the appearance of his monograph on this group. Both Dr. Bartsch and Dr. Harald Rehder of the National Museum were particularly helpful on problems connected with the survey of the shells from Monterey in the vast collection at Washington.

Appreciation goes also to Mr. and Mrs. Emery P. Chace of Lomita, California, Tom and John Q. Burch of Los Angeles, Dr. A. Myra Keen of Stanford University, the late George Willett of the Los Angeles Museum, Professor William J. Raymond of Berkeley, the Rev. Elwood B. Hunter and Mr. Andrew Sorensen of Pacific Grove, and Mr. John Strohbeen of Santa Cruz, all of whom have been generous with the loan of specimens for study and for invaluable information. We are especially indebted to Drs. G. Dallas Hanna and Leo G. Hertlein of the Academy's staff for much assistance, encouragement, and advice throughout the period this study has been under way.

PELECYPODA

PRIONODESMACEA

SOLEMYACIDAE

Solemya panamensis Dall—9 fathoms off Pacific Grove, in coarse granitic sand; one specimen (Gordon).

Solemya valvulus Carpenter—10-25 fathoms off Monterey, in sand; rare.

NUCULIDAE

Nucula cardara Dall—43-108 fathoms off Point Pinos and Santa Cruz, in soft green or dark mud (USFC Stas. 4475, 4482, 4483, 4523); fairly common.

Nucula carlottensis Dall—581 fathoms off mouth of Salinas River, in green mud and sand (USFC Sta. 3670); rare.

Nucula linki Dall—51 fathoms off Point Pinos, in soft dark gray mud (USFC Sta. 4464); rare.

Nucula tenuis (Montagu)—15-149 fathoms, in mud, sand and clay; fairly common.

Acila castrensis (Hinds)—15-149 fathoms, in mud, sand and clay; common.

NUCULANIDAE

Nuculana acuta (Conrad)—28-35 fathoms off Point Pinos, in blue mud, sand and shells USFC Sta. 4441); rare. While the shells to which we refer here are close to the East Coast's *N. acuta*, there are differences that may result eventually in classifying them

- as a separate species. Until recently, collectors have incorrectly applied the name *acuta* to the fairly common subglobose shell with a short rostrum, which is properly identified as *N. penderi* (Dall).
- **Nuculana ambliia* (Dall)—465-1041 fathoms off Point Pinos, in green, blue and soft gray mud, and hard sand (USFC Stas. 3128, 4516, 4517, 4530, 4536-9, inclusive); abundant.
- Nuculana conceptionis* (Dall)—298 fathoms off Point Sur, in yellow sand and mud (USFC Sta. 3187); one specimen.
- [*Nuculana cuneata* (Sowerby)—Monterey (Cooper). This is not *N. cuneata* (Sowerby), which is a synonym of *N. clenensis* (Sowerby). Early collectors applied the name to the species that Dall called *N. acuta* (Conrad).]
- Nuculana hamata* (Carpenter)—35-158 fathoms, in mud and sand; fairly common.
- Nuculana leonina* (Dall)—152-766 fathoms off Point Pinos and mouth of Salinas River, in green mud, sand and rocks (USFC Stas. 3202, 4509, 4514, 4517, 4541); fairly common.
- Nuculana penderi* (Dall and Bartsch)—8-35 fathoms, in sand; common.
- Nuculana taphria* (Dall)—8-51 fathoms, in coarse and fine sand; abundant. Common in fish stomachs (Sorensen).
- Yoldia beringiana* Dall—152-1041 fathoms off Point Pinos, in hard sand and blue and soft gray mud (USFC Stas. 3128, 4509, 4536); scarce.
- **Yoldia cooperi* Gabb—5-15 fathoms off Soquel, in sand; scarce.
- **Yoldia montereyensis* Dall—25 fathoms (Mrs. Oldroyd); 60 fathoms (Lowe); 152-871 fathoms off Point Pinos and mouth of Salinas River, in mud and sand (USFC Stas. 3128, 3202, 3670, 4509, 4514, 4517, 4538, 4540, 4541, 4542); common.
- Yoldia scissurata* Dall—35-139 fathoms, in mud. Common in fish stomachs (Sorensen). Syn. *Y. ensifera* Dall.
- Yoldia seminuda* Dall—21 fathoms off Monterey, in sand; one living specimen (Gordon).
- Malletia faba* Dall—581-627 fathoms off Point Pinos and mouth of Salinas River, in mud (USFC Stas. 3128, 3670).
- Malletia pacifica* Dall—152-329 fathoms off Point Pinos, in soft gray mud (USFC Sta. 4509); rare.
- Tindaria gibbsii* Dall—755-958 fathoms off Point Pinos, in soft gray mud (USFC Sta. 4530); rare.

ARCIDAE

- Glycymeris suboboleta* (Carpenter)—5-15 fathoms off Pacific Grove, in coarse granitic sand, valves only; scarce.
- [*Arca bailyi* Bartsch—recorded as *Barbatia gradata* Sowerby from 12 fathoms, sand, by Berry who now states that the record is extremely doubtful. The name *A. pernoides* (Carpenter), an indeterminate species from San Diego, has also been applied to this shell.]

PINNIDAE

- Philobrya setosa* (Carpenter)—5-40 fathoms, on sea mosses and calcareous algae, off Pacific Grove and Monterey; common.

OSTREIDAE

- Ostrea laperosii* Schrenck—Elkhorn Slough; introduced for commercial propagation. Syn. *O. gigas* Thunberg, not *O. gigas* Meuschen.
- Ostrea lurida* Carpenter—Sub-littoral in the Bay, in mud and on rocks and shells; fairly common.

* An asterisk preceding a species' name in the checklist indicates the Monterey region is the type locality. Brackets ([]) indicate erroneous or doubtful records. Since the manuscript was completed several years prior to date of publication changes in some names have been recommended. It has not been practicable to make these and a few other minor alterations such as to bring all information strictly up to date.

Ostrea lurida expansa Carpenter—Monterey Harbor (Dall). Possibly a situs form of the preceding species.

Ostrea virginica Gmelin—Elkhorn Slough; introduced for commercial use.

PECTINIDAE

Pecten (Pecten) diegensis Dall—10-40 fathoms, in sand and on shale; fairly common. Like the rest of the Monterey pectens it is often found free-swimming.

[*Pecten (Plagioctenium) circularis* Sowerby—Monterey (Dall). According to Hertlein this must be considered a doubtful record, as true *circularis* is not known to range into California. The southern California shell is the subspecies *aequisulcatus* Carpenter, also not found in the Bay.]

Pecten (Chlamys) hastatus Sowerby—10-40 fathoms, in sand and on shale and corallines, sometimes encased in sponge; fairly common.

Pecten (Chlamys) hericeus Gould—10-20 fathoms, in sand. Fine living specimens were taken years ago by trawl fishermen but recent dredging has failed to locate any bed and has produced only a few valves.

Pecten (Chlamys) hericeus pugetensis I. S. Oldroyd—40 fathoms off Monterey, on shale (Burch).

[*Pecten (Chlamys) hindsii* Carpenter—Monterey (Cooper, Dall); beach at Pt. Lobos, as *navarchus* (Leitch). Not taken recently and the records need confirming. Young *Hinnites multirugosus* Gale or worn valves of *P. hastatus* Sowerby or *P. hericeus* Gould may have been mistaken for this species. Syn. *P. h. navarchus* Dall.]

[*Pecten (Leptopecten) latiauratus* Conrad—Monterey (Dall). Dall's immature specimen is the only record of this common southern California pecten.]

Pecten (Leptopecten) latiauratus monotimeris Conrad—Fan Shell Beach, near Cypress Point; 15-40 fathoms in Monterey Bay, on calcareous algae; common. This is the small form with prominently laminated interspaces named as *P. l. delosi* Arnold although the smoother form is collected occasionally. Syn. *P. l. delosi* Arnold.

Pecten (Delectopecten) randolphi tillamookensis Arnold—659 fathoms off Point Pinos, in green mud (USFC Sta. 5699); one specimen.

Pecten (Delectopecten) vancouverensis Whiteaves—15-220 fathoms, on calcareous algae and bryozoans; scarce.

Hinnites multirugosus (Gale)—Low tide to 12 fathoms; free-swimming when young, the adults cement themselves to rocks. 30 fathoms (Cooper). Fairly common. Syn. *H. giganteus* Gray.

LIMIDAE

Lima dehiscens Conrad—10-35 fathoms, nesting in sand or free-swimming; fairly common.

Lima subauriculata (Montagu)—20 fathoms off Monterey, on shale (Burch). 25 fathoms off Carmel; in sand; scarce.

ANOMIIDAE

[*Anomia peruviana* d'Orbigny—60 fathoms (Cooper). A doubtful record for this southern species.]

Pododesmus macrochismus (Deshayes)—Low tide to 20 fathoms, on rocks, on living abalones and in dead shells, especially mussels; common.

MYTILIDAE

Mytilus californianus Conrad—On rocks at low tide, especially along the ocean front; abundant.

Mytilus edulis Linnaeus—On wharf piles, Monterey Municipal Pier and Moss Landing; abundant. "Santa Cruz near river" (Cooper).

Septifer bifurcatus (Conrad)—Under rocks at low tide; fairly common.

[*Volsella capax* (Conrad)—Elkhorn Slough (McGinitie). Based on young specimens,

- which may have been *V. fornicatus* Carpenter. We have seen no authentic specimens of *capax* from the vicinity of Monterey. Syn. *Modiolus capax* Conrad.]
- Volsella flabellata* (Gould)—15-40 fathoms off Moss Landing and Santa Cruz, in sand; rare. Dr. Berry has a large specimen from Moss Landing measuring 210 mm. in length. Syn. *Modiolus flabellatus* (Gould).
- Volsella diegensis* (Dall)—With *Mytilus edulis*, Monterey Municipal Pier; in rock fill at Elkhorn Slough; fairly common. Also 12 fathoms off Del Monte, on shale; scarce. This species is not a boring mollusk and we believe it to be a *Volsella* rather than a *Botula*. Syn. *Botula diegensis* Dall.
- Volsella fornicata* (Carpenter)—Low tide to 40 fathoms, nestling among rocks, shells, and in fine gravel; abundant. While dredging in 5-15 fathoms in the lee of Point Pinos over a sand and broken shell bottom the shells brought up in the dredge were largely worn and broken valves of this species. Syn. *Modiolus fornicatus* Carpenter.
- [*Volsella modiola* (Linnaeus)—Monterey (Cooper). A doubtful record for this northern species that needs confirming. Syn. *Modiolus modiolus* (Linnaeus).]
- Volsella pallidula* (Dall)—41-142 fathoms, in mud; fairly common. Syn. *Modiolus pallidulus* Dall.
- Volsella recta* (Conrad)—Elkhorn Slough, in mud at low tide; 10-20 fathoms, in sand; common. Syn. *Modiolus rectus* Conrad.
- Botulina denticulata* (Dall)—5-40 fathoms, in sand, shale, and broken shells; scarce. Shells we identify as this species have until recently been called *Modiolus opifex* Say, an East Coast species. Specimens from the West Coast are provisionally included under *denticulata*, although those from Monterey and other localities in California are lighter in color and smaller than typical specimens from Lower California, and may be separable.
- Botula californiensis* (Philippi)—8-15 fathoms, boring in shale; scarce.
- **Botula falcata* (Gould)—Low tide at Santa Cruz, in shale; also 10-15 fathoms off Del Monte, boring in shale; common.
- [*Lithophaga attenuata* (Deshayes)—Monterey (Dall). Dall's record was based on senile specimens of *L. plumula* (Hanley). San Ignacio Lagoon, Lower California, is the northernmost record for this species in the California Academy Collection.]
- Lithophaga plumula* (Hanley)—Low tide to 35 fathoms, boring in shale and occasionally in shells; common.
- [*Modiolaria protracta* (Dall)—Monterey (Dall). Dall's record was based on a small worn valve of *Botulina denticulata* (Dall), dredged by Berry in 12 fathoms off Del Monte.]
- Crenella columbiana* Dall—15-40 fathoms, in sand and mud; fairly common.
- Crenella decussata* (Montagu)—15-30 fathoms, in sand; scarce.
- [*Crenella inflata* Carpenter—25 fathoms (Berry). A doubtful record for this Cape San Lucas species.]

ANOMALODESMACEA

PERIPLMATIDAE

- Periploma discus* Stearns—15-25 fathoms off Del Monte, in sand; rare.

THRACIIDAE

- Thracia challsiana* Dall—Beach at Pacific Grove (Gordon, Mrs. Fackenthal); rare.
- Thracia curta* Conrad—25 fathoms off Pacific Grove (Berry).
- Thracia trapezoides* Dall—A single young specimen from 35 fathoms off Seaside, in mud (Gordon).
- Cyathodonta undulata* Conrad—Fragments from 12 fathoms off Del Monte, in sand (Gordon).

PANDORIDAE

- Pandora bilirata* Conrad—41-142 fathoms, in mud, clay and gravel; fairly common.

Pandora filosa (Carpenter)—40-202 fathoms off Watsonville Beach and Point Pinos, in dark green or soft dark gray mud and in coarse sand, shells and rocks (USFC Stas. 3204, 4457, 4464, 4549); scarce.

Pandora punctata Conrad—10-15 fathoms, in sand; common.

LYONSIIDAE

Lyonsia californica Conrad—10-40 fathoms, in sand; common.

Lyonsia gouldii Dall—5-15 fathoms, in sand (Gordon); rare.

Entodesma inflatum (Conrad)—At low tide, in sponges and ascidians, to 40 fathoms, on shale; rare.

Entodesma saxicola (Baird)—Between tides, under boulders and in rock crevices; fairly common.

Mytilimeria nuttallii Conrad—In compound ascidians (*Amaroucium californicum* and other species), usually in colonies at low tide. Also dredged from 10-20 fathoms off Monterey (Burch). Fairly common.

POROMYACIDAE

**Dermatomya buttoni* Dall—581 fathoms off mouth of Salinas River, in mud (USFC Sta. 3670); rare.

**Dermatomya tenuiconcha* (Dall)—66-73 fathoms off Point Pinos, in green mud and rocks (USFC Sta. 4552); 659 fathoms off Point Sur, in green mud (USFC Sta. 5699); rare.

CUSPIDARIIDAE

Cuspidaria apodema Dall—70 fathoms, in mud (McGinitie); 85-158 fathoms off Point Pinos, in soft green mud (USFC Sta. 4475); scarce.

Cardiomya californica (Dall)—34-73 fathoms off Point Pinos, in mud and rocks (USFC Stas. 4457, 4474, 4552). Syn. *Cuspidaria californica* Dall.

Cardiomya pectinata (Carpenter)—66-69 fathoms off Point Pinos, in green mud and rocks (USFC Sta. 4555). Syn. *Cuspidaria pectinata* (Carpenter).

Cardiomya planetica (Dall)—40-202 fathoms off Point Pinos, Watsonville Beach and Santa Cruz, in soft green mud and sand (USFC Stas. 3204, 4475, 4482, 4483, 4485). Syn. *Cuspidaria planetica* (Dall).

VERTICORDIIDAE

Verticordia ornata (d'Orbigny)—25 fathoms, in sand, Monterey and Carmel Bays; scarce.

TELEODESMACEA

CARDITIDAE

Glans carpenteri Lamy—Shore to 15 fathoms, under rocks and among rubble and broken shells; abundant. Syn. *Cardita subquadrata* (Carpenter).

[*Cardita crebricostata* (Krause)—Monterey (Dall). Dall's specimens belong under *C. ventricosa montereyensis* Smith and Gordon, new subspecies. True *crebricostata* does not appear to have been recorded south of Oregon.]

Cardita prolongata (Carpenter)—5-25 fathoms off Pacific Grove and 25 fathoms, in sand; rare.

**Cardita ventricosa montereyensis* Smith and Gordon, new subspecies. Described on page 212; see text figs. 2, 3; 35-139 fathoms, in mud and fine sand; fairly common.

Milneria kelseyi Dall—China Point, under rocks, and 10 fathoms off China Point on sand and broken shell bottom; scarce.

**Milneria minima* Dall—10-15 fathoms, in sand and shells; rare.

CHAMIDAE

[*Chama buddiana* C. B. Adams—Monterey (Dall). This record was based upon a specimen of *Pseudochama grantii* Strong.]

Chama pellucida Broderip—Between tides, cemented to rocks, often on their undersides; fairly common. Specimens from Monterey Bay generally are small and lack the pink color of those found farther to the south.

Pseudochama exogyra (Conrad)—With the above, but found only on the upper faces of rocks. Once fairly common, this species is now hard to find.

Pseudochama granti Strong—25-60 fathoms in Monterey Bay, on rocks and shells; 25 fathoms, in Carmel Bay; fairly common.

THYASIRIDAE

Axinopsis sericatus (Carpenter)—15-25 fathoms, in sand and mud; fairly common.

Axinopsis viridis Dall—36-85 fathoms off Point Pinos, in soft dark gray and green mud (USFC Stas. 4464, 4475); 298 fathoms off Point Sur, in yellow sand and mud (USFC Sta. 3187).

UNGULINIDAE (DIPLDONTIDAE)

Taras orbellus (Gould)—Occasionally found at low tide and in beach drift. 3-15 fathoms, in sand and rocks; scarce. Usually nestles in borer holes. Syn. *Diplodonta orbella* (Gould).

Taras sericatus (Reeve)—15 fathoms, in sand; one young specimen (Gordon). Dredged off Monterey (Burch). Syn. *Diplodonta sericata* (Reeve).

LUCINIDAE

Lucina annulata Reeve—8-10 fathoms (Dall). Fragments dredged in 25 fathoms in sand (Gordon). A young specimen from a kelp holdfast in 10 fathoms (Smith).

Lucina approximata (Dall)—10-70 fathoms, in sand and mud; fairly common.

Lucina californica Conrad—Shore to 40 fathoms, in sand and gravel; common.

Lucina nuttalli Conrad—15 fathoms, in sand; rare.

Lucina tenuisculpta (Carpenter)—19 fathoms off Watsonville Beach, in mud, fine sand and stones (USFC Sta. 3138); rare.

[*Divaricella parparvula* Dall—"Monterey" (Gabb). This record is unquestionably erroneous.]

ERYCINIDAE (LEPTONIDAE)

Kellia laperousii (Deshayes)—Shore to 35 fathoms, nestling in kelp holdfasts; rock crevices, and borer holes; also in salt-water tank at the Hopkins Marine Laboratory; abundant.

Kellia suborbicularis (Montagu)—With the preceding species and may include it. Apparently this name has been used as a catch-all for West American shells of *K. laperousii* tending toward the orbicular.

Rochefortia aleutica (Dall)—10-35 fathoms, in fine sand and shale fragments; fairly common.

Rochefortia tumida (Carpenter)—Shore to 40 fathoms (Berry). We have not collected it and suspect Berry's shells may be the preceding species.

Serridens oblonga (Carpenter)—Monterey, commensal on *Ischnochiton heathiano* (Berry); rare (Chace).

**Sportella* (?) *californica* Dall—15-25 fathoms off Pacific Grove and Point Pinos, in fine sand; scarce. This shell is not a *Sportella* and may be a species of *Pseudopythina*.

[*Pseudopythina compressa* Dall—Elkhorn Slough (McGinitie). The single specimen so identified is actually a large pathologic individual of *P. rugifera* (Carpenter).]

Pseudopythina rugifera (Carpenter)—Elkhorn Slough, commensal on shrimps of the genus *Upogebia* (McGinitie). 60-70 fathoms off Monterey, in mud, on the undersides of *Aphrodite* worms.

Bornia retifera Dall—Monterey Harbor (Dall). Not taken recently.

Lasaca cistula Keen—In kelp holdfasts and nestling among mussels; common. This species, and *L. subviridis* Dall, are frequently found in collections under the incorrect name *L. rubra* (Montagu).

Lasaca subviridis Dall—In kelp holdfasts; also 5-15 fathoms, in sand. Less common than the preceding species.

**Anisodonta pellucida* Dall—12 fathoms off Del Monte, in sand (Berry). Known only from the type specimen.

CHLAMYDOCONCHIDAE

Chlamydoconcha orcutti Dall—Between tides, on rocks (Heath); rare.

CARDIIDAE

Cardium (Trachycardium) quadragenarium Conrad—12-30 fathoms, in sand and shale fragments; fairly common.

Cardium (Clinocardium) fucanum Dall—10-40 fathoms, in sand; fairly common. This species is often misidentified as *C. californiense* Deshayes, which is a northern species not found in California in spite of its name.

Cardium (Clinocardium) nuttalli Conrad—Elkhorn Slough, in mud; common. Dredged in depths under 20 fathoms (Burch). This species has been incorrectly called *C. corbis* (Martyn).

[*Cardium (Laevicardium) substriatum* Conrad—Monterey (Cooper). A doubtful record.]

**Nemocardium centiflosum* (Carpenter)—10-40 fathoms in Monterey Bay, in mud and sand, scarce; 15 fathoms off Carmel (Cooper). Syn. *Protocardia centiflosa* (Carpenter).

VESICOMYACIDAE

Vesicomya gigas (Dall)—659 fathoms off Point Sur, in green mud (USFC Sta. 5699); a single specimen.

Vesicomya ovalis (Dall)—415-659 fathoms off Point Sur, in green mud (USFC Stas. 5698, 5699); rare.

VENERIDAE

Tivela stultorum (Mawe)—Moss Landing, in sand at low tide; fairly common. Reported as common at Santa Cruz in 1861 by Cooper but now found there rarely, if at all.

Transennella tantilla (Gould)—Low tide to 20 fathoms, in sand; abundant.

Pitar newcombianus (Gabb)—30 fathoms, in sand (Cooper). No specimens appear to have been collected recently.

Antigona fordii (Yates)—6-40 fathoms, in sand and shale fragments; rare.

Saxidomus giganteus (Deshayes)—10-12 fathoms off Del Monte, in sand; rare.

Saxidomus nuttalli Conrad—Pacific Grove, in sand and small rocks at low tide; scarce. Elkhorn Slough; common in mud and gravel. Many young specimens dredged down to 20 fathoms, in sand.

Compsomyax subdiaphana (Carpenter)—10-40 fathoms, in sand and mud; common. Syn. *Marcia subdiaphana* (Carpenter).

Humularia kennerleyi (Reeve)—Dredged in shallow water off Monterey (Burch); Beach at Carmel, one valve (Keep); a few miles south of Carmel (Chace). Syn. *Marcia kennerleyi* (Reeve).

[*Chione succincta* (Valenciennes)—Three young specimens, listed as *C. simillima* Sowerby, 30 fathoms in Carmel Bay, in mud (Cooper). This is a doubtful record for this southern species. Cooper's shells may have been the young of *Protothaca staminea ruderata* (Deshayes.)]

Protothaca laciniata (Carpenter)—10-20 fathoms off Del Monte, in sand; valves and fragments only. Syn. *Paphia laciniata* (Carpenter).

Protothaca staminea (Conrad)—Between tides, in sand and gravel; also to 25 fathoms in sand and shale fragments or nestling in borer holes in shale. Distorted specimens growing in borer holes have been named *P. s. orbella* (Carpenter) and *P. s. petiti* (Deshayes). The frilled variety, *P. s. ruderata* (Deshayes), may be subgenerically distinct. Syn. *Paphia staminea* (Conrad).

Protothaca tenerrima (Carpenter)—Elkhorn Slough; rare. Cooper reported one valve in 20 fathoms and said "it lives below low tide at Santa Cruz." Immature valves in 12 fathoms (Berry). Syn. *Paphia tenerrima* (Carpenter).

**Irus lamellifer* (Conrad)—Low tide to 35 fathoms, in gravel or nestling in borer holes; common. Syn. *Venerupis lamellifera* (Conrad).

Gemma gemma (Totten)—15 fathoms off Pacific Grove, in sand; one specimen (Gordon). Introduced with oysters from the East Coast.

Psephidia brunnea Dall—Monterey (Dall). We have not collected it.

Psephidia lordi (Baird)—10-30 fathoms, in sand and mud; fairly common.

[*Psephidia ovalis* Dall—12 fathoms (Berry). This record needs confirming.]

Psephidia salmonea (Carpenter)—10 fathoms off China (Cabrillo) Point, in sand; fairly common (Smith).

PETRICOLIDAE

Petricola carditoides (Conrad)—Low tide to 40 fathoms, in borer holes; common.

[*Petricola californiensis* Pilsbry and Lowe—Reported as *P. denticulata* Sowerby from 25 fathoms by Berry, on Dall's identification. Berry's specimens, on analysis, prove to be young valves of the preceding species.]

COOPERELLIDAE

Cooperella subdiaphana (Carpenter)—15-40 fathoms, in sand; fairly common.

TELLINIDAE

Tellina bodegensis Hinds—Below low tide to 15 fathoms, in sand; fairly common.

Tellina buttoni Dall—10-25 fathoms, in sand; common.

Tellina carpenteri Dall—15-75 fathoms, in sand and mud; scarce.

Tellina modesta (Carpenter)—15-25 fathoms, in sand; scarce.

Tellina salmonea (Carpenter)—5-40 fathoms, in coarse sand; fairly common.

Macoma calcarea (Gmelin)—36-51 fathoms off Point Pinos, in soft dark gray mud (USFC Sta. 4464); one specimen.

Macoma carlottensis Whiteaves—40-286 fathoms off Point Pinos and mouth of Salinas River, in soft green or gray mud, gray sand, and a combination of mud, sand and boulders (USFC Stas. 3666, 4457, 4475, 4509, 4522, 4523, 4555); common.

Macoma expansa Carpenter—Monterey (Hannibal). 45 fathoms off Santa Cruz, in soft green mud (USFC Sta. 4483).

Macoma inconspicua (Broderip and Sowerby)—Elkhorn Slough, in mud, to 10 fathoms, in sand. Originally described as *Tellina inconspicua* Broderip and Sowerby.

Macoma indentata Carpenter—9-25 fathoms, in coarse to fine sand; rare.

Macoma irus Hanley—Common at Elkhorn Slough, in mud. Syn. *M. inquinata* (Deshayes).

Macoma nasuta (Conrad)—Abundant in Elkhorn Slough, in mud and fine sand. Dredged down to 25 fathoms off Monterey (Burch).

Macoma quadrana Dall—40-153 fathoms, in mud; scarce.

Macoma secta (Conrad)—Abundant in Elkhorn Slough, in mud and sand.

Macoma yoldiformis Carpenter—10-25 fathoms, in sand and shale fragments; common. 40 fathoms off Moss Landing (Berry).

SEMELIDAE

- Semele incongrua* Carpenter—5-25 fathoms, in coarse to fine sand or nestling in borer holes in the shale; common. 20-30 fathoms in muddy sand, Carmel Bay (Cooper). [*Semele pulchra* (Sowerby)—Monterey Bay (Dall). Dall's record is based on a single valve. This record needs confirming.]
- **Semele rubropicta* Dall—Low tide to 35 fathoms off Monterey and Soquel; beach at Point Pinos and Carmel. While valves of this fine red-rayed species are found occasionally, good living specimens are rare.
- **Semele rupicola* Dall—Nestling in borer holes in shale, 15-25 fathoms off Del Monte, scarce; shore at Pacific Grove and Santa Cruz, valves only.
- Cumingia californica* Conrad—Nestling among small rocks and gravel, and in borer holes, low tide to 35 fathoms; fairly common.

SANGUINOLARIIDAE

- Gari californica* (Conrad)—Between tides, in coarse granitic sand, gravel and granite boulders. Young specimens down to 15 fathoms off Pacific Grove, in fine sand; scarce. Syn. *Psammobia californica* Conrad.
- Sanguinolaria nuttallii* Conrad—Elkhorn Slough; in mud; rare.
- Heterodonax bimaculatus* (Linnaeus)—Below low tide at Fan Shell Beach, near Cypress Point, (Dall; Mrs. Fackenthal); rare. Only separate valves have been collected.
- Tagelus californianus* (Conrad)—Elkhorn Slough; one valve (Hanna).

SOLENIDAE

- Solen sicarius* Gould—Low tide to 40 fathoms, in mud and sand; fairly common. Elkhorn Slough, in mud; scarce.
- Ensis californicus* Dall—Young specimens taken in 15 fathoms off Pacific Grove, in sand (Gordon).
- Siliqua lucida* (Conrad)—10-25 fathoms off Monterey, in sand; fairly common.
- Siliqua patula* (Dixon)—Beach at seaside, valves only; mouth of Elkhorn Slough; scarce. Syn. *S. patula nuttallii* (Conrad).

MACTRIDAE

- Mactra californica* Conrad—Elkhorn Slough (McGinitie). Reported common on the beach at Santa Cruz by Cooper. 12 fathoms off Del Monte, in sand and shale fragments; one specimen (Smith).
- Spisula catilliformis* (Conrad)—Off Soquel, in sand (Stanford Collection). 40 fathoms off Moss Landing (Berry). A rare species in the Bay.
- Spisula falcata* Gould—15 fathoms off Pacific Grove, in sand (Gordon); rare. Valves in 10 fathoms and living "toward Salinas River" (Cooper).
- Spisula hemphilli* Dall—15 fathoms off Cabrillo Point, in sand; one valve (Gordon).
- Spisula planulata* Conrad—Elkhorn Slough, in mud; scarce. 12 fathoms off Del Monte; common (Berry).
- Schizothaerus nuttallii* (Conrad)—Abundant in Elkhorn Slough. In borer holes in a shale boulder at Del Monte (Chace). Living young and valves off Monterey in 20 fathoms (Burch).

MYACIDAE

- Mya arenaria* Linnaeus—Elkhorn Slough, in mud; common. Introduced.
- [*Mya intermedia* Dall—Monterey (Dall). Two young specimens, one from Monterey and the other from 45 fathoms off Point Año Nuevo are the basis for this record. Whether they are the young of this or another species is difficult to determine.]
- Cryptomya californica* (Conrad)—Nestling in rocks and gravel at low tide at Pacific Grove; fairly common. Abundant at Elkhorn Slough, where it extends its siphons

into the burrows of shrimps of the genera *Callinassa* and *Upogebia*, and the worm *Urechis caupo*. Beach to 20 fathoms (Cooper). Nestling in borer holes in shale at Del Monte (Chace).

Sphenia pholadidea Dall—Beach at Monterey, as *S. nana* (Oldroyd), and at the Hopkins Marine Station, as *S. globula*, one valve (Keen); 8-35 fathoms off Pacific Grove and Monterey, boring in shale; fairly common. The California sphenias appear to have been divided into too many species and we are of the opinion that there is but one in the Monterey region. In this connection there has been some confusion between *S. nana* (Oldroyd) and *S. globula* Dall. According to Dr. Keen, there are two paratypes of *globula* in the Stanford Collection, which, with the holotype in the National Museum, were collected at Bolinas by Hemphill. The Monterey specimen of *globula* cited by Mrs. Oldroyd (1927, 1:201) is a young *Platydon cancellatus* (Conrad). Because of the variable shape of shells of this genus that are referable to the species named above, this becomes a questionable character for diagnosis and we are therefore relegating *S. nana* and *S. globula* to the synonymy of *S. pholadidea* after a study of photographs of the type specimen of the latter species, which were kindly furnished by Dr. Keen. We have not collected *S. fragilis* Carpenter at Monterey, the only material in the Academy Collection being from south of San Diego, which shows this species to be quite different from *pholadidea*. No shells of *S. ovoidea* Carpenter have been available for comparison of our Monterey material with this species. Syns. *Cuspidaria nana* Oldroyd; *S. nana* (Oldroyd); *S. globula* Dall.

Platydon cancellatus (Conrad)—Low tide at Santa Cruz, in shale; fairly common.

ALOIDIDAE (CORBULIDAE)

[*Aloidis fragilis* (Hinds)—Monterey (Dall). Dall's single beach-worn valve of this Panamic species is probably adventitious. Syn. *Corbula fragilis* Hinds.]

Aloidis luteola (Carpenter)—25 fathoms off Carmel, in sand; a single specimen. Syn. *Corbula luteola* Carpenter.

SAXICAVIDAE

Panope generosa Gould—Beach at Del Monte (Gordon); Elkhorn Slough (Ricketts).

A young dead specimen, 15 fathoms off Monterey, in sand (Smith). Scarce.

Saxicava arctica (Linnaeus)—Shore to 63 fathoms, nestling in kelp holdfasts, borer holes, and other sheltered places; abundant.

Saxicava pholadis (Linnaeus)—8-25 fathoms, in borer holes in shale; scarce.

Saxicavella pacifica Dall—Valves in 25 fathoms off Carmel, in sand; rare.

PHOLADIDAE

Zirfaca pilsbryi Lowe—Elkhorn Slough, in mud; scarce. Formerly identified as *Z. gabbi* Tryon.

Parapholas californica (Conrad)—8-25 fathoms, in shale. Also in shale boulders washed ashore at Del Monte. A large specimen in the Berry Collection measures 145x71x68 mm.

**Pholadidea ovoidea* (Gould)—8-25 fathoms, in shale. Common in 12 fathoms.

Pholadidea parva (Tryon)—Boring in shells of the red abalone; common.

Pholadidea penita (Conrad)—8-40 fathoms, in shale; fairly common.

Pholadidea penita concamerata Deshayes. There appear to be no recent authentic records of this subspecies from the region.

**Pholadidea penita sagitta* Dall—Found with the typical variety; abundant. According to Dr. Keen, this subspecies is the predominant form of *penita* in the Bay.

Pholadidea rostrata (Valenciennes)—8-25 fathoms, in shale; fairly common. This species has been misidentified as the South American *P. darwini* (Sowerby), which is a very different shell.

Navea subglobosa Gray—Monterey Harbor (Dall); boring in shells of the red abalone, fairly common (Keen); 10-40 fathoms in shale; common.

**Xylophaga californica* Bartsch—75-108 fathoms off Point Pinos, in soft dark mud (USFC Sta. 4523).

Xylophaga mexicana Dall—Monterey (Dall). We have not collected it.

TEREDIDAE

Bankia setacea (Tryon)—In wharf pilings; common.

Teredo diegensis Bartsch—Elkhorn Slough (R. C. Miller).

SCAPHOPODA

SOLENOCONCHA

DENTALIIDAE

**Dentalium berryi* Smith and Gordon, new species. Described on p. 216, see pl. 3, figs. 1-4; 20-40 fathoms off Monterey, in mud and sand; scarce.

Dentalium neoheptagonum Sharp and Pilsbry—9-40 fathoms, in sand; abundant.

Dentalium pretiosum Sowerby—Off Monterey (Cooper); 20 fathoms off Carmel, in sand; rare (Smith). The Carmel specimens are longer, more slender, more widely curved, and more pointed than typical shells of this species from Puget Sound and Alaska; one has a slit on the outside of the curve, which is a feature not present in any specimens of *D. pretiosum* we have examined. They are therefore referred to *pretiosum* with some doubt. Cooper's shells may have been these, or *D. berryi* Smith and Gordon.

Dentalium rectius Carpenter—35-70 fathoms, in mud; common.

Dentalium semipolatum Broderip and Sowerby—9-35 fathoms off Monterey and Pacific Grove, in coarse to fine sand; scarce. Although the original description calls for "no notch or slit," several adult specimens we have examined have a prominent notch at the apex on the outside of the curve; young shells occasionally have a deep narrow slit. These occur together with specimens having no notch. Therefore, we believe that *D. hannai* Baker, proposed for shells differing from *D. semipolatum* only in the notch, is synonymous with the latter species.

Dentalium vallicolens Raymond—161-265 fathoms off Point Pinos, in mud (USFC Sta. 4462); a fragment.

Cadulus fusiformis Pilsbry and Sharp—10-40 fathoms, in sand; abundant.

Cadulus hepburni Dall—43-45 fathoms off Santa Cruz, in soft green mud (USFC Stas. 4482, 4483); 80 fathoms off Point Pinos, a single specimen (Gordon). Scarce.

Cadulus perpusillus (Sowerby)—36-69 fathoms off Point Pinos, in soft green and dark gray mud and rocks (USFC Stas. 4464, 4483); scarce.

Cadulus tolmiei Dall—627 fathoms off Monterey, in blue mud (USFC Sta. 3128); rare.

GASTROPODA

PTEROPODA

SPIRATELLIDAE

**Spiratella pacifica* (Dall)—Pelagic. Monterey, dead on the beach, 1866 (Dall).

CAVOLINIDAE

Cavolina tricuspidata (Rivers)—Pelagic. Occasionally found on shore after winter storms. Syn. *C. occidentalis* Dall.

CYMBULIIDAE

Corolla spectabilis Dall—Pelagic. Monterey (Dall).

Corolla vitrea (Heath and Spaulding)—According to Heath (1901), a large number of

individuals of this species were taken at or near the surface of Monterey Bay and twice since that time (December 27, 1900) great shoals have been noted in the same locality. Syn. *Cymbulioopsis vitrea* Heath and Spaulding.

PNEUMODERMATIDAE

**Pneumoderma pacifica* Dall—Pelagic off the coast (Dall).

OPISTHOBRANCHIATA

ACTEONIDAE

**Acteon punctocaelata* (Carpenter)—3-25 fathoms, in sand; common.

Microglyphis breviculus Dall—66-73 fathoms off Point Pinos, in green mud and rocks (USFC Sta. 4552); rare.

ACTEONINIDAE

Acteocina culcitella (Gould)—10-25 fathoms, in sand; scarce.

Acteocina culcitella intermedia Willett—10-30 fathoms, in sand; common.

Acteocina eximia (Baird)—20-158 fathoms, in mud and fine sand; fairly common.

[*Acteocina inculta* (Gould)—Monterey (Dall). This record is based on a worn specimen of *Retusa harpa* (Dall).]

**Retusa harpa* (Dall)—10-40 fathoms, in fine sand and mud; common. Found frequently in beach drift.

**Retusa montereyensis* Smith and Gordon, new species. Described on p. 217; see pl. 3, fig. 11; 15 fathoms off Del Monte, in sand; 25 fathoms off Pacific Grove; rare.

Volvulella californica Dall—45 fathoms off Santa Cruz, in soft green mud (USFC Sta. 4483); 298 fathoms off Point Sur, in mud and yellow sand (USFC Sta. 3187); rare.

Volvulella cooperi Dall—Point Sur (Dall).

Volvulella cylindrica (Carpenter)—15-63 fathoms, in sand and mud; scarce.

DIAPHANIDAE

Diaphana californica Dall—10-25 fathoms, in sand and kelp holdfasts; rare (Smith).

[*Cylichna alba* (Brown)—Monterey (Dall). Probably the following, as we have seen only one species of *Cylichna* from the Monterey region.]

Cylichna attonsa (Carpenter)—10-40 fathoms, in sand and mud; common. Until better evidence is at hand we are tentatively referring the common Monterey shell to this species.

AKERIDAE

Haminoca vesicula (Gould)—Elkhorn Slough; seasonally abundant. Santa Cruz, living in Soquel Creek estuary (Cooper).

GASTROPTERIDAE

Gastropteron pacificum Bergh—Dredged in Monterey Bay; rare (MacFarland).

AGLAJIDAE

Navanax inermis (Cooper)—Elkhorn Slough; rare (McGinitie).

Aglaja diomedea (Bergh)—Elkhorn Slough (McGinitie).

APLYSIIDAE

Tethys californicus (Cooper)—Shore to 5 fathoms, on kelp. Elkhorn Slough (McGinitie). *Tethys californicus* (subspecies?)—According to Berry, a small red form, very different from the shore form in appearance, was dredged by him in 12 fathoms. It may prove to be distinct.

Phyllaplysia taylori Dall—On eel-grass of the genus *Zostera*, near Monterey (MacFarland); Elkhorn Slough (McGinitie).

PLEUROBRANCHIDAE

- Pleurobranchus californicus* Dall—Pacific Grove, at low tide under rocks; rare (Smith).
Pleurobranchaea (species?)—Dredged (MacFarland).

NUDIBRANCHIATA

DUVAUCELIIDAE

- **Duvaucelia exsulans* (Bergh)—Dredged off Año Nuevo Point and in Monterey Bay (MacFarland).
 **Duvaucelia (Tritonia) festiva* (Stearns)—Monterey to Point Lobos and Point Sur (MacFarland). Point Pinos (Stearns, Costello).
Duvaucelia tetraquetra (Pallas)—Dredged in Monterey Bay (MacFarland).

POLYCERIDAE

- **Aegirus (Aegires) albopunctatus* MacFarland—Monterey to Point Lobos (MacFarland); low tide at Pacific Grove (Berry); extreme low water, on stones, at Santa Cruz (Cooper).
 **Laila cockerelli* MacFarland—Cabrillo Point; Point Aulon; Point Pinos to Point Lobos; scarce (MacFarland).
 **Triopha carpenteri* (Stearns)—Monterey to Point Sur; common in tide pools (MacFarland); Point Pinos (Stearns); common on brown kelp (Costello).
Triopha catalinae Cooper—Santa Cruz; rare on stones at extreme low water (Cooper). Not reported by MacFarland.
 **Triopha grandis* MacFarland—Cabrillo Point to Point Sur, on kelp beds of the genus *Macrocystis* off shore along the coast (MacFarland).
 **Triopha maculata* MacFarland—Cabrillo Point to Point Lobos; common in rocky tide pools along the coast (MacFarland).
 **Polycera atra* MacFarland—Cabrillo Point; abundant. Also common from Point Pinos to Cypress Point (MacFarland).
 **Acanthodoris brunnea* MacFarland—5-10 fathoms off Monterey; scarce (MacFarland). 12 fathoms off Del Monte (Berry).
 **Acanthodoris hudsoni* MacFarland—Point Pinos; rare in tide pools at extreme low water (MacFarland).
 **Ancula pacifica* MacFarland—In tide pools at Cabrillo Point, Point Pinos, Cypress Point, and Point Lobos; rare (MacFarland).
 **Hopkinsia rosacea* MacFarland—Common in tide pools at Cabrillo Point, Point Pinos, Cypress Point, and Point Lobos (MacFarland).

CORAMBIDAE

- **Corambe pacifica* MacFarland and O'Donoghue—Common off Monterey and Pacific Grove, on brown kelp bearing colonies of the bryozoan *Membranipora villosa* Hincks (MacFarland).

DORIDIDAE

- **Cadlina flavomaculata* MacFarland—Cabrillo Point to Pescadero Point; scarce. (MacFarland, Costello).
 **Cadlina marginata* MacFarland—In tide pools all along the coast from Cabrillo Point to beyond Point Lobos, scarce (MacFarland); shore to 25 fathoms (Berry).
Glossodoris (Chromodoris) californiensis (Bergh)—Point Pinos, very rare (MacFarland); fairly common in tide pools near Monterey (Snook and Johnson).
 **Glossodoris (Chromodoris) porterae* (Cockerell)—Point Pinos; rare (MacFarland).
 **Rostanga pulchra* MacFarland—Abundant at Cabrillo Point, Point Aulon, and Point Pinos; less so at Cypress Point, Pescadero Point, and Point Lobos (MacFarland).

Aldisa sanguinea (Cooper)—Common in rocky tide pools from Monterey to Point Lobos (MacFarland).

**Archidoris montereyensis* (Cooper)—Abundant in tide pools and on wharf piles (MacFarland). 7 fathoms on rock (Cooper). 25 fathoms (Berry).

**Anisodoris nobilis* (MacFarland)—Abundant in tide pools all along the shore of Monterey Bay, and to the northward and southward (MacFarland).

Diaulula sandiegensis (Cooper)—Common in tide pools (MacFarland).

**Discodoris heathi* MacFarland—Scarce in tide pools at Cabrillo Point, Point Pinos, Pescadero Point, and Cypress Point (MacFarland).

**Dendrodoris (Doriopsis) fulva* (MacFarland)—Common all along the coast in rocky tide pools (MacFarland). Shore to 25 fathoms (Berry).

ARMINIDAE

Armina (Pleurophyllidia) californica (Bergh)—Dredged off Monterey on sandy bottom (MacFarland).

DIRONIDAE

**Dirona albolineata* MacFarland—Cabrillo Point and Point Pinos, in rocky tide pools; rare.

**Dirona picta* MacFarland—Common in rocky tide pools from Monterey to Point Sur (MacFarland).

DENDRONOTIDAE

Dendronotus giganteus O'Donoghue—Dredged in deep water at various stations in Monterey Bay (MacFarland).

FIMBRIIDAE

Melibe leonina (Gould)—On kelp beds; scarce. (MacFarland, Fewkes).

HANCOCKIIDAE

**Hancockia californica* MacFarland—Common at Cabrillo Point; less so at Point Pinos and Cypress Point (MacFarland).

FLABELLINIDAE

Flabellina iodinea (Cooper)—On wharf piles at Monterey and in rocky tide pools at Cabrillo Point and Point Pinos; scarce (MacFarland); rare on algae at extreme low water at Santa Cruz (Cooper).

FIONIDAE

Fiona pinnata (Eschscholtz)—On driftwood bearing cirripede colonies in Monterey Bay and the open ocean (MacFarland).

AEOLIDIIDAE

Hermisenda crassicornis (Eschscholtz)—Common on wharf piles, old boat hulls, and in tide pools in Monterey Bay and all along the coast (MacFarland); Elkhorn Slough (McGinitie).

Aeolidia hercules Bergh—On sea anemone beds near the mouth of Waddell Creek, north of Santa Cruz; tide pools in Monterey Bay, south to Point Sur and beyond (MacFarland). Elkhorn Slough (McGinitie). This may be *A. papillosa* (Linnaeus) according to MacFarland.

PULMONATA

ELLOBIIDAE

Phytia setifer (Cooper)—Elkhorn Slough, 2 miles above the highway bridge, in *Salicornia*; abundant (Hanna).

Melampus olivaceus Carpenter—Mouth of the Salinas River (Dall). We have not collected it and have seen no specimens from this locality. There is a possibility that it may be found living in Elkhorn Slough.

TRIMUSCULIDAE (GADINIIDAE)

Trimusculus reticulatus (Sowerby)—Low tide, under rocks; scarce. Also large colonies on the roofs of caves exposed at low tide between Point Pinos and Point Lobos. Syn. *Gadinea reticulata* (Sowerby).

SIPHONARIIDAE

Williamia peltoides (Carpenter)—Below low tide mark. Living in 10-12 fathoms; scarce. (Berry, Smith).

**Williamia vernalis* (Dall)—Low tide to 12 fathoms, on rocks and shale fragments; fairly common. Also common in beach drift.

CTENOBRANCHIATA

CONIDAE

Conus californicus Hinds—Low tide, in sand pockets among rocks, to 15 fathoms; scarce.

TURRIDAE

Megasurcula carpenteriana (Gabb)—12-204 fathoms, in mud and fine sand; fairly common.

**Megasurcula granti* Bartsch—Monterey, Stearns Collection (Bartsch).

Megasurcula stearnsiana (Raymond)—20-55 fathoms, in mud; rare. In the Berry Collection is a splendid specimen from 20 fathoms off the Hopkins Marine Laboratory measuring 64.1 x 25.3 mm. (SSB No. 1991).

Megasurcula tremperiana (Dall)—Occurs with *M. carpenteriana* and may be only a variant of it. Its relationship to *M. granti* may be very close.

**Irenosyrinx amycus* (Dall)—795-871 fathoms off Point Pinos, in hard gray sand (USFC Sta. 4538); rare. Syn. *Leucosyrinx amycus* Dall.

[*Ophiodermella halcyonis* (Dall)—Monterey (Dall). See *O. montereyensis* Bartsch. Syn. *Clathrodrillia halcyonis* (Dall).]

**Ophiodermella montereyensis* Bartsch—Type from 13 fathoms, in fine sand and mud (USFC Sta. 3134); also 13-19 fathoms, on sand and mud and rock bottom (USFC Stas. 3138, 3142); 3 specimens. 10-50 fathoms, in sand; scarce. Shells from Monterey Bay identified as *O. halcyonis* (Dall) probably belong to this species.

Ophiodermella ophioderma (Dall)—From depths between 5 and 12 fathoms we have dredged specimens that do not appear to differ in any marked particulars from those collected in the San Pedro region. Santa Cruz (Cooper). It is scarce in the Bay. Syn. *Clathrodrillia incisa ophioderma* Dall.

[*Pseudomelatoma moesta* (Carpenter)—Monterey (Dall). Bartsch states there is no specimen from Monterey in the National Museum. The record needs confirming.]

**Pseudomelatoma torosa* (Carpenter)—Low tide to 35 fathoms, on rocks; scarce in shallow water but fairly common on the shale at 35 fathoms. Santa Cruz (Cooper). Includes the color form *P. t. aurantia* (Carpenter).

**Crassispira montereyensis* (Stearns)—Below low tide mark, in rock crevices and kelp holdfasts; rare.

**Carinoturris adrastia* (Dall)—581 fathoms off mouth of Salinas River, in green mud and sand (USFC Sta. 3670); rare. Syn. *Cryptogemma adrastia* Dall.

**Carinoturris fortis* (Bartsch)—Type specimen from 298 fathoms, in yellow sand and mud (USFC Sta. 3187). Known only from the type.

**Rhodopetoma amycus* (Dall)—581 fathoms off mouth of Salinas River, in green mud and sand (USFC Sta. 3670); known only from the type specimen. Syn. *Antiplanes amycus* (Dall).

**Antiplanes diomedea* Bartsch—328 fathoms off Point Sur, in black sand and mud (USFC Sta. 3186). Known only from the type specimen.

Antiplanes major Bartsch—43-278 fathoms off Point Año Nuevo and at several stations

- in Monterey Bay, on bottoms composed of various grades of mud and sand (USFC Stas. 3115, 3129, 3147, 3666, 3669, 4483). Sometimes taken on a clay or gravel bottom. About 200 fathoms, 14 miles off Davenport, Santa Cruz County, brought up by set-line fishermen, whose hooks occasionally snag a species of sea anemone growing on the shell (Strohbeen). Appears to be fairly common in depths between 50 and 75 fathoms.
- [*Antiplanes perversa* (Gabb)—As now considered by Bartsch, this species has so far only been dredged off Catalina Island. Records of *A. perversa* from Monterey Bay should probably be referred to the preceding species.]
- Antiplanes profundicola* Bartsch—659 fathoms off Point Sur, in green mud (USFC Sta. 5699); two specimens.
- [*Rectiplanes santarosana* (Dall)—Point Sur (Dall). The shells on which this record is based could not be found in the National Museum and according to Bartsch it is doubtful, at best, for this southern California species. Syn. *Antiplanes santarosana* (Dall).]
- **Borsonella pinosensis* Bartsch—40-50 fathoms off Point Pinos, in green mud and fine sand (USFC Stas. 4452, 4457); 3 specimens.
- **Propebela casentina* (Dall)—795-871 fathoms off Point Pinos, in hard gray sand (USFC Sta. 4538); rare. Syn. *Lora casentina* Dall.
- **Propebela diomedea* Bartsch—581 fathoms off mouth of Salinas River, Monterey Bay, in mud (USFC Sta. 3670); type and three topotypes. Recorded from Monterey by Dall as *Lora exarata* (Möller).
- **Propebela montercalis* (Dall)—With the preceding species; rare. Syn. *Lora montercalis* Dall.
- **Propebela pitysa* (Dall)—66-73 off Point Pinos, in green mud and rocks (USFC Sta. 4552); 4 specimens. (Syn. *Lora pitysa* Dall).
- **Propebela profundicola* Bartsch—Type specimens from 871 fathoms off Point Pinos, on gray sand and rock bottom (USFC Sta. 4538). Listed from Monterey Bay as *Lora popovia* Dall, which is now considered as strictly Aleutian by Bartsch.
- **Propebela smithi* Bartsch—Type specimen from 293-386 fathoms off Point Pinos, in soft green mud (USFC Sta. 4508). Known only from the type.
- **Propebela surana* (Dall)—298 fathoms off Point Sur, in yellow sand and mud (USFC Sta. 3187); 6 specimens. Syn. *Lora surana* Dall.
- [*Propebela tabulata* (Carpenter)—Monterey (Dall). Except for three beach-worn specimens, which Dall labeled as having been collected by him at Monterey, this species is not known to have been collected south of Neah Bay. We suspect Dall's shells did not come from Monterey. Syn. *Lora tabulata* (Carpenter).]
- Glyphostoma cymodoce* Dall—80 fathoms, in mud and gravel; one specimen (Gordon). In the National Museum are two lots from Monterey Bay collected by Cooper (6 specimens) and from the Stearns Collection (4 specimens).
- **Glyphostoma canfieldi* (Dall)—At low tide, in rocky pockets in sand among eel-grass roots, Pacific Grove and Point Pinos. Syn. *Philbertia canfieldi* (Dall).
- Glyphostoma hesione* (Dall)—Point Pinos (Dall). According to Bartsch there are no specimens from Monterey in the National Museum. Its occurrence in the Monterey fauna needs confirming. Syn. *Philbertia hesione* Dall.
- **Kurtzia gordonii* Bartsch—10-20 fathoms, in sand; fairly common. Type and 3 topotypes from 43-46 fathoms off Santa Cruz, in green mud (USFC Sta. 4482). 40-158 fathoms off Santa Cruz and Point Pinos, generally on mud bottom (USFC Stas. 4457, 4464, 4475, 4483); 9 specimens. Shells of this species from Monterey have been identified by Dall and others as *Mangelia artcaqa roperi* Dall.
- **Kurtzina beta* (Dall)—Type dredged in 56 fathoms off Point Año Nuevo, in brown mud (USFC Sta. 3147); 40-46 fathoms off Point Pinos, in dark green mud (USFC Sta. 4457), 1 specimen; 60 fathoms off Point Pinos in soft dark gray mud (USFC

- Sta. 4464), 2 specimens. Taken rarely in 40 fathoms, in mud or on a sand bottom. Syn. *Mangelia beta* Dall.
- Mangelia barborensis* Oldroyd—10-50 fathoms, in mud and sand; common. Syn. *M. angulata* Carpenter.
- Mangelia hecetae* Dall and Bartsch—10-15 fathoms, in sand; rare. There is one lot in the National Museum from Monterey. Originally, we identified these shells as *M. crebricostata* Carpenter, but Dr. Bartsch believes they belong under *M. hecetae*.
- **Mangelia interlirata* Stearns—Beach drift and at low tide; occasional.
- [*Mangelia levidensis* Carpenter—Monterey (Dall). This should be considered a doubtful record, as Bartsch states there are no specimens in the National Museum from Monterey.]
- **Mangelia perattenuata* Dall—10-45 fathoms, in mud (Woodworth). Known only from the type, which is a badly worn shell.
- **Mangelia philodice* Dall—65-71 fathoms off Point Pinos, in green mud, sand, and gravel (USFC Sta. 4454); rare.
- Mangelia variegata* Carpenter—Below low tide mark. Syns. *M. pulchrior* Dall; *M. nitens* Carpenter.
- Cytharella hexagona* (Gabb)—10-20 fathoms, in sand, off Monterey; rare. Carmel Bay (Cooper).
- [*Cytharella merita* (Hinds)—Monterey (Dall). This record is probably an error as the species is found farther to the south.]
- **Daphnella fuscoligata* Dall—5-15 fathoms, in rocky and shale crevices; also in kelp holdfasts and in the beach drift; rare. Syn. *Mangelia (Mitromorpha) crassaspera* Grant and Gale.

CANCELLARIIDAE

- Cancellaria cooperi* Gabb—15-300 fathoms, in mud; rare. Recently Mr. John Strohbeen has obtained nearly a dozen specimens from fishermen operating set-lines for sable fish in about 200 fathoms off Davenport, Santa Cruz County. The living shells are occasionally brought up when a species of sea anemone that grows on them, apparently attaches itself to the bait. This is one of the most striking and sought after species in the Bay.
- Cancellaria crawfordiana* Dall—50-70 fathoms, in mud; scarce.
- Admete couthouyi* (Jay)—45 fathoms off Santa Cruz, in soft green mud (USFC Sta. 4483); 52-59 fathoms off Point Pinos, in green mud (USFC Sta. 4446); rare.
- Admete couthouyi* (subspecies?)—394-406 fathoms off Point Pinos, in green mud and rocks (USFC Sta. 4514). The deep-water form has much finer sculpture than the preceding, approaching *A. middendorffiana* Dall; rare.
- Admete rhyssa* Dall—65-71 fathoms off Point Pinos, in green mud, sand, and gravel (USFC Sta. 4554); rare. Although labeled *A. californica* (Dall), this lot in the U. S. National Museum appears to be *A. rhyssa*.
- **Admete woodworthi* Dall—10-45 fathoms (Woodworth). Also 50 fathoms off Point Pinos, in green mud and fine sand (USFC Sta. 4552). Evidently a rare species as we have not dredged it in the Bay.

OLIVIDAE

- Olivella biplicata* (Sowerby)—In colonies at low tide, in sand; abundant. Dredged down to about 20 fathoms (Burch).
- Olivella baetica* Carpenter—5-40 fathoms in Monterey and Carmel Bays, in sand; common. In older collections, shells of this species were often labeled *O. pedroana* Conrad. Following T. S. Oldroyd's classification (Nautilus, 34(4):117) they would be called *O. baetica diegensis* T. S. Oldroyd. Large shells, typical of *O. baetica* from Alaska, have not been reported from Monterey.

[*Olivella pedroana* (Conrad)—This species was based on a Pleistocene fossil from San Pedro. As the type has been lost it appears to be unidentifiable and so we are eliminating it from this list as an authentic species found within the Monterey region. We are referring shells formerly called *O. pedroana* to *O. baetica* Carpenter. Study of a series of *Olivellas* from the San Pedro Pleistocene in the Academy's collection leads us to the suspicion that *O. pycna* Berry and *O. pedroana* (Conrad) may be synonymous.]

Olivella pycna Berry—Living at low tide, in sand, on the beach below "Pop Ernest's" famous restaurant at Monterey (D. S. and E. W. Gifford); 10-15 fathoms in sand, Monterey Bay; 20 fathoms, in sand, Carmel Bay; fairly common. This is the species that has sometimes been labeled *O. intorta* Carpenter, which is a Mexican shell.

MARGINELLIDAE

Marginella jewettii Carpenter—Beach drift; common. Living shells rarely found in small colonies, in sand, at the roots of eel-grass among rocks at low tide. Dredged down to 20 fathoms.

Marginella regularis Carpenter—Shore to 20 fathoms, living on or under rocks; fairly common.

Marginella subtrigona Carpenter—Monterey (Dall). Beach drift at Pacific Grove (Smith).

Cypraeolina pyriformis (Carpenter)—In tide pools and at low tide in algae and sea mosses; abundant. Dredged down to about 40 fathoms (Burch).

VOLUTIDAE

[*Scaphella arnheimi* Rivers—According to Dall (U. S. Geol. Surv. Prof. Paper 59, 1909, p. 210) "the shell is really from Magellan Straits" and in an unpublished note by him in the National Museum it is stated that a specimen of *S. magellanica* (Sowerby), dredged by the *Albatross* in the Straits of Magellan, was stolen by a sailor and sold to J. J. Rivers as a Monterey Bay shell. Rivers mistakenly described it as new. The specimen was destroyed in the San Francisco fire of 1906.]

MITRIDAE

**Mitra montereyi* Berry—Dead shells rare in beach drift. Living specimens dredged from 5-40 fathoms, on shale; scarce. The southern analog of this species is *M. idae* Melvill, which has a slenderer shell with somewhat rougher sculpture.

**Mitromorpha aspera* (Carpenter)—Shore to 15 fathoms, on rocks, in shale fragments, and in beach drift; fairly common. May include *M. interfossa* (Carpenter).

Mitromorpha filosa (Carpenter)—At low tide, under rocks; rare.

**Mitromorpha gracilior* (Tryon)—Low tide to 15 fathoms; common. Syn. *M. intermedia* Arnold.

PTYCHATRACTIDAE

Ptychatractus californicus Dall—36-51 fathoms off Point Pinos, in soft dark gray mud (USFC Sta. 4464); one young specimen.

**Mctzgeria montereyana* Smith and Gordon, new species. Described on p. 218; see pl. 3, fig. 6; 15 fathoms, in fine sand and shale fragments, off Del Monte. Known only from the type specimen.

FUSINIDAE

Fusinus barbarensis (Trask)—63-80 fathoms, in gravel; scarce.

[*Fusinus kobelti* (Dall)—Monterey (Dall). This record, based on an immature living specimen collected by Stearns, is subject to doubt. We have not seen this species from the Bay.]

- **Fusinus luteopictus* (Dall)—Low tide, under rocks, to 15 fathoms; fairly common but not nearly so abundant as in southern California and seems near to the northern end of its range.
- Fusinus monksae* Dall—8-35 fathoms off Del Monte, on shale; fairly common. There is a question whether shells from Monterey Bay usually so named are really *F. monksae* or a new species. Syn. *F. robustus* (Trask).

NEPTUNEIDAE (CHRYSODOMIDAE)

- [*Macron lividus* (A. Adams)—4 specimens of this southern California species in the National Museum are labeled as coming from Monterey. We have never taken it and regard the record as extremely doubtful.]
- Mohmia vernalis* Dall—581 fathoms off mouth of Salinas River, in green mud and sand (USFC Sta. 3670); rare.
- Exiliodia rectirostris* (Carpenter)—389-456 fathoms off Point Pinos, in green mud (USFC Sta. 4513); rare. Syn. *Exilia rectirostris* (Carpenter).
- Plicifusus griseus* Dall—381-633 fathoms off Point Pinos, in green mud and sand (USFC Stas. 4513, 4541); scarce.
- Colus aphelus* (Dall)—750-766 fathoms off Point Pinos, in green mud and sand (USFC Sta. 4517); one specimen.
- Colus clementinus* Dall—627 fathoms off Point Pinos, in blue mud (USFC Sta. 3128); rare.
- Colus georgianus* Dall—750-766 fathoms off Point Pinos, in green mud and sand (USFC Sta. 4517); rare.
- Colus halidonus* Dall—331-633 fathoms off Point Pinos, in hard sand and green mud (USFC Stas. 4541, 4542); rare.
- Colus jordani* (Dall)—633 fathoms (Dall). In the National Museum there is a single specimen from 381-633 fathoms off Point Pinos, in green mud and sand (USFC Sta. 4541), and a lot of four specimens from 581 fathoms off mouth of Salinas River, in green mud and fine sand (USFC Sta. 3670), under this name. They probably represent a new species, allied to but not identical with *C. jordani*.
- **Colus severinus* (Dall)—278 fathoms off mouth of Salinas River, in green mud and fine sand (USFC Sta. 3669); 296 fathoms off Point Año Nuevo, in fine gray sand (USFC Sta. 3112); scarce.
- Colus trophius* (Dall)—750-766 fathoms off Point Pinos, in green mud and sand (USFC Sta. 4517); rare.
- Neptuncea amianta* Dall—One dead specimen in 42 fathoms off Pigeon Point (Bolin); 278-871 fathoms off Point Pinos and mouth of Salinas River, in green mud and various grades of sand (USFC Stas. 3127, 3669, 3670, 4513, 4517, 4538); fairly common. About 200 fathoms, 14 miles off Davenport, Santa Cruz County, brought up by set-line fishermen; about ten specimens of all sizes (Strohbeen).
- **Neptuncea ithia* Dall—204-382 fathoms off Point Sur, Point Pinos, and mouth of Salinas River, in green and soft gray mud and black and fine sand (USFC Stas. 3186, 3202, 3669, 4526); scarce. Brought up by set-line fishermen with the preceding species; about a dozen specimens (Strohbeen).
- Neptuncea lirata* (Marty)—755-847 fathoms off Point Pinos, in soft gray mud (USFC Sta. 4530); one immature specimen.
- Neptuncea tabulata* (Baird)—Worn shell from the beach at Seaside; 50-80 fathoms off Moss Landing, in mud, clay, and gravel; 202 fathoms off Watsonville Beach, in black sand (USFC Sta. 3204). Brought up by set-line fishermen; 15 specimens (Strohbeen). Scarce.
- Scarlesia dira* (Reeve)—Monterey (Dall). Dall's very worn dead specimen in the National Museum is the only record from the Bay. We have not taken it there or

elsewhere in the Monterey region, although it occurs a few miles north of Pigeon Point.

BUCCINIDAE

Buccinum strigillatum Dall—278 fathoms off mouth of Salinas River, in green mud and sand (USFC Sta. 3669); one specimen.

Buccinum viridum Dall—331-871 fathoms off Point Pinos and mouth of Salinas River, principally in green mud but occasionally on a sand bottom (USFC Stas. 3670, 4513, 4514, 4516, 4517, 4538, 4540, 4541, 4542); common.

NASSARIIDAE (ALECTRIONIDAE)

Nassarius californianus (Conrad)—30-40 fathoms off Moss Landing and Soquel Point, in mud and sand; rare.

Nassarius cooperi (Forbes)—3-25 fathoms, in sand; abundant.

Nassarius fossatus (Gould)—Elkhorn Slough, common; 10 fathoms off Monterey, in sand, rare.

Nassarius insculptus (Carpenter)—40-73 fathoms off Point Pinos, in green mud, sand, and gravel (USFC Stas. 4452, 4454, 4457); scarce.

Nassarius mendicus (Gould)—With *N. cooperi*; abundant.

Nassarius perpinguis (Hinds)—5-25 fathoms, in sand; common.

PYRENIDAE (COLUMBELLIDAE)

Anachis penicillata Carpenter—Monterey (Cooper). We have not taken it although the range of this species has been extended as far north as Pescadero (Smith).

**Mitrella aurantiaca* Dall—At low tide, on rocks and among sea mosses; scarce.

Mitrella carinata (Hinds)—Shore to 15 fathoms, on rocks and kelp; common.

Mitrella carinata californiana (Reeve)—With the preceding, but more plentiful.

Mitrella carinata hindsii (Reeve)—With *carinata*; less common.

Mitrella gausapata Gould—With *carinata*; abundant.

Mitrella gouldii (Carpenter)—39-356 fathoms off Point Pinos, mouth of Salinas River, and Santa Cruz, in soft green and dark gray mud, sand, and shells (USFC Stas. 3666, 4475, 4485, 4508, 4522, 4523); fairly common. This and *M. lutulenta* were formerly placed in the genus *Nitidella*.

Mitrella hypodra Dall—One beach-worn specimen at Monterey (Dall).

Mitrella lutulenta (Dall)—10-73 fathoms, in mud and fine sand; common. This species is separated with some difficulty from *M. gouldii* on the basis of smaller size and shorter spire.

Mitrella tuberosa (Carpenter)—Shore to 20 fathoms, in sand and rocks. Santa Cruz, living at low water (Cooper). Specimens dredged in abundance off Monterey have transverse finlike ridges of epidermis on the body whorl.

[**Aesopus goforthi* Dall—Monterey? (Goforth). We suspect that Goforth's single specimen of questioned locality came from more southern waters.]

**Amphissa bicolor* Dall—66-356 fathoms off Point Pinos and mouth of Salinas River, in soft green and gray mud and sand (USFC Stas. 3666, 4462, 4508, 4509, 4526, 4552); common. Also 298 fathoms off Point Sur, in yellow sand and mud (USFC Sta. 3187), which is the locality of the figured type.

Amphissa columbiana Dall—A large form of *Amphissa*, which is definitely not *A. versicolor* Dall, is found rarely under rocks at low tide. It is provisionally referred to *columbiana*, although it is quite different from typical northern shells of this species.

Amphissa reticulata Dall—10-60 fathoms, in sand and mud; scarce. The relationship between this species and *A. versicolor incisa* Dall seems close.

**Amphissa versicolor* Dall—Shore to 15 fathoms, on rocks; abundant at low tide. Two color varieties, described as *A. v. cymata* Dall and *A. v. lineata* Stearns, are also

found occasionally. Many other color forms of this handsome little species could be named from Monterey but they would have small scientific validity.

Amphissa versicolor incisa Dall—10-12 fathoms off Del Monte, in sand and shale fragments; rare.

Amphissa undata (Carpenter)—15-40 fathoms, in sand; scarce.

MURICIDAE

**Murex carpenteri* (Dall)—7-35 fathoms, on shale, off Pacific Grove, Monterey, and Del Monte; fairly common. This is the shell that some collectors have been calling *M. petri* Dall, although the true *petri* (Syn. *M. rhyssus* Dall) is a southern species not certainly reported from the Monterey region.

Murex tremperi Dall—With the preceding species, but scarce. There has been much confusion between this species and *M. carpenteri* owing to Dall's error in figuring a San Diego specimen as *carpenteri*. Monterey Bay specimens of *tremperi* are less delicately frilled and larger than *carpenteri*. From southern California shells of this species they differ by being more imbricate and the varices have frequent and more pointed digitations, which are often strongly recurved at the tips. The name *tremperi* was proposed by Dall for a banded color variety of the southern California form, the types of which are in the California Academy's collection. Syn. *M. carpenteri tremperi* Dall.

Purpura foliata Martyn—Shore at low tide, among rocks under kelp, to 15 fathoms; fairly common. Dredged specimens are beautifully frilled, of which there are several in one of the main cases of the Pacific Grove Museum.

[*Purpura nuttalli* (Conrad)—Recorded from Monterey by Dall and Berry. The latter now states that his shell is undoubtedly a form of *P. foliata* (Martyn). We have not seen specimens of true *nuttalli* from the Monterey region and consider the record to be an exceedingly doubtful one.]

Ocenebra barbarensis (Gabb)—10-40 fathoms, on shale fragments; scarce. The group of species listed under *Ocenebra* have previously been described under *Ocenebra* (mistake in spelling) and *Tritonalia*.

**Ocenebra beta* (Dall)—8-35 fathoms on rocks and shale; common. Specimens submitted to the National Museum for comparison with the type establish its identity as *beta* instead of a new species as previously supposed. It is the shallow water analog of *O. barbarensis*, from which it differs mainly in its heavier shell, with shorter spire and canal. It is not related to *O. interfossa* (Carpenter), although described as a subspecies of it.

**Ocenebra circumtexta* Stearns—Between tides, on rocks, especially those a short distance off shore; common.

[*Ocenebra foveolata* (Hinds)—Monterey (Dall). Whether typical *foveolata* actually occurs in the Monterey region seems to depend on the range of variation allowed the species. As we have not collected adult shells identical with the usual southern California form, we are provisionally assigning the Monterey shells of this group to *O. fusconotata* (Dall).]

**Ocenebra fusconotata* (Dall)—3-15 fathoms, on rocks and in shale and kelp holdfasts; scarce. Differs from *foveolata* in its smaller size, brown markings on a ground color of dirty white, and in being more strongly imbricate and elegantly sculptured.

Ocenebra gracillima Stearns—Between tides, on rocks; scarce. Monterey specimens have coarser sculpture than is found on shells of this species collected in southern California. They were described as *O. stearnsi* Hemphill, which becomes a synonym of *gracillima*. *O. gracillima obesa* (Dall), also reported from Monterey, appears to be of doubtful taxonomic value.

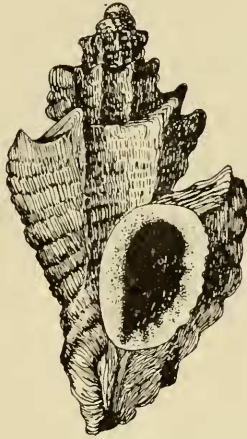


FIG. 1. *Ocenebra beta* (Dall). Hypotype. C.A.S. Paleo. Type Coll. No. 8563. Length, 15.8; max. diam., 9.0 mm. (G. D. Hanna, del.)

**Ocenebra interfossa* Carpenter—Shore at moderately low tide, to 10 fathoms, under rocks; commonest of the ocenebras in the Bay. Carpenter's type, in the National Museum, came from Monterey.

Ocenebra interfossa clathrata (Dall)—Shore to 15 fathoms, on shale. From a study of a large growth series, Berry believes this to be a separate species.

Ocenebra lurida aspera (Baird)—Low tide to 10 fathoms, on granite boulders and other rocks; abundant. Monterey shells of this subspecies are not as large or as heavily sculptured as specimens from northern localities. They are brilliantly colored, with yellow and red-brown predominating. There is a possibility that Baird's subspecies is a synonym of the typical form and hence we use his name provisionally for shells from the Monterey region. *O. lurida rotunda* (Dall), found occasionally with *aspera*, is considered to be a variant without real subspecific standing.

Ocenebra lurida munda (Carpenter)—Low tide to 10 fathoms, found with the preceding but much less common.

Ocenebra subangulata (Stearns)—Shore, on granite rocks, to 15 fathoms, on shale; rare. Comparison of Monterey and other northern California specimens with typical shells of *O. michaeli* from Cayucos shows no appreciable differences. Syn. *O. michaeli* Ford.

Urosalpinx cinereus (Say)—Elkhorn Slough; fairly common. Introduced with seed oysters from the Atlantic Coast.

Boreotrophon avalonensis (Dall)—Monterey Bay, in 40 fathoms (Burch).

Boreotrophon calliceratus (Dall)—65-71 fathoms off Point Pinos, in green mud, sand, and gravel (USFC Sta. 4454); one specimen. This is more robust than those from the original lot and strongly resembles *B. triangulatus* (Carpenter).

[*Boreotrophon multicostatus* (Eschscholtz)—20 fathoms (Cooper). As this northern species has not been reported from the Bay in recent years, we believe Cooper's shells were another species, possibly *B. triangulatus* (Carpenter).]

Boreotrophon smithi (Dall)—46-71 fathoms off Point Pinos, in green mud, sand, shells and rocks (USFC Stas. 4535, 4551, 4555, scarce; 75 fathoms off Santa Cruz, with *Laqueus californianus* (Koch) on rock (Bolin). A single specimen with rather high spire from the beach at Point Pinos (Sorensen).

- Boreotrophon stuarti* (E. A. Smith)—202 fathoms off Watsonville Beach, in black sand (USFC Sta. 3204); rare.
- Boreotrophon triangulatus* (Carpenter)—20-40 fathoms, on shale; scarce. Syn. *B. peregrinus* (Dall).
- **Trophonopsis lasius* (Dall)—152-495 fathoms off Point Pinos, in green mud, coarse sand, and shells (USFC Stas. 4509, 4515); scarce.
- Trophonopsis triphurus* (Dall)—581 fathoms off mouth of Salinas River, in green mud and sand (USFC Sta. 3670); rare.
- **Thais canaliculata compressa* Dall—Scarce between tides, on rocks along the ocean front, but common under beds of mussels exposed at low tide at the tips of Point Pinos, and Pescadero, and Carmelo Points.
- Thais emarginata* (Deshayes)—On rocks, between tides; abundant. Unusually large and fine shells of this species, varying in color and sculpture, are to be found nearly everywhere.
- Thais emarginata ostrina* (Gould)—Between tides, on rocks along the ocean front; common.
- Thais lamellosa* (Gmelin)—Common on the beach at the mouth of Scott Creek, 15 miles north of Santa Cruz (Mr. and Mrs. Harry Turver). Not recorded from Monterey Bay or the ocean front of the Monterey Peninsula. The Scott Creek shells are probably the subspecies *franciscana* Dall.
- [*Thais lima* (Martyn)—Monterey (Dall, Berry). We have not collected this Alaskan species at Monterey and suspect that the published records of it there are based on misidentifications of *T. canaliculata compressa* Dall or one of the numerous variations of *T. emarginata* (Deshayes).]
- Acanthina spirata* (Blainville)—On rocks between tides at Monterey, Elkhorn Slough, Santa Cruz and elsewhere; scarce. The color form *A. s. aurantia* Dall is found rarely.
- Acanthina spirata punctulata* (Sowerby)—On rocks between tides; abundant. It does not intergrade with the preceding species in the Bay. Formerly identified as *A. lapilloides* (Conrad).

EPITONIIDAE

- Opalia chacei* (Strong)—Below low tide mark, under granite boulders, scarce. Also in the beach drift. California shells incorrectly identified in collections as *O. xerobleswskyi* Mörch) or *O. borealis* (Gould) belong to this species.
- Opalia evicta* (de Boury)—On shore in beach drift to 35 fathoms, on shale; scarce.
- **Opalia montereyensis* (Dall)—25 fathoms off Del Monte, in mud; two specimens (Berry). Strong, Nautilus, 51(1):6, states that this species may prove to be identical with *O. evicta* (de Boury), in which case the latter will become a synonym of *montereyensis*.
- Epitonium (Dontiscala) insculptum* (Carpenter)—Monterey (Dall). We have not collected it and believe the record to be doubtful for this southern species. Syn. *E. crenimarginatum* (Dall).
- Epitonium (Asperiscala) bellastriatum* (Carpenter)—10-25 fathoms, in fine dark sand and shale fragments; fairly common.
- [*Epitonium (Nodiscala) rectiporosum* (Carpenter)—15-25 fathoms, in fine dark sand and shale fragments; rare. May be a synonym of the next species.]
- **Epitonium (Nodiscala) spongiosum* (Carpenter)—Monterey, "shell washings" (Cooper). We have seen only one species of the subgenus *Nodiscala* from the California coast and are of the opinion that shells belonging to it are properly identified as *spongiosum*.
- **Epitonium (Nitidiscala) berryi* (Dall)—12 fathoms off Del Monte (Berry). Apparently this is only a variety of *E. rectilaminatum* Dall. The type of *berryi* is the only known specimen from Monterey.

Epitonium (Nitidiscala) columbianum Dall—10-20 fathoms off Santa Cruz, in dark sand and rock fragments; rare (Gordon). Off Monterey in 20 fathoms, on shale (Burch).

[*Epitonium (Nitidiscala) cooperi* Strong—Monterey (Dall). We have seen no authentic specimens of this southern California species from Monterey. The record needs confirming. Syn. *E. fallaciosum* Dall.]

[*Epitonium (Nitidiscala) crebricostatum* (Carpenter)—Monterey (Cooper). Strong (1930) states that this species is indeterminate until a type is chosen that agrees with Carpenter's description. He believes it to be possibly an extreme variant of *E. tinctum*. The reference to the type as being in the University of California "State Collection" by Oldroyd (1927, 2, 2:61) is incorrect according to Strong, as the shells probably referred to proved to be *E. tinctum*. The Monterey record is therefore a doubtful one.]

[*Epitonium (Nitidiscala) hexagonum* (Sowerby)—Santa Cruz (Dall). An extremely doubtful record for this Lower California species. Dall's shell may have been *Opalia evicta* (De Boury), with which *hexagonum* might be confused.]

Epitonium (Nitidiscala) indianorum (Carpenter)—65-71 fathoms off Point Pinos, in green mud, sand, and gravel (USFC Sta. 4454). Although stated by Cooper to be common at Santa Cruz, living at low water, in all probability his shells were some other species, possibly *E. tinctum* (Carpenter). We have not collected typical *indianorum* at Monterey, either on shore or by dredging in moderately shallow depths.

Epitonium (Nitidiscala) rectilaminatum (Dall)—10-15 fathoms off Monterey, in fine dark sand and shale fragments; fairly common.

**Epitonium (Nitidiscala) regionontanum* Dall—10-30 fathoms off Monterey, in sand. We have not collected it.

Epitonium (Nitidiscala) savinae (Dall)—10-56 fathoms, in fine dark sand and shale fragments; fairly common.

Epitonium (Nitidiscala) tinctum (Carpenter)—Shore to 10 fathoms. This is the most abundant of the ladder-shells or wentletraps in the Bay, which may be found living among colonies of the common small green sea anemone (*Cribrina xanthogrammatica* Brandt) on rocks between tides nearly everywhere. Syn. *E. subcoronatum* (Carpenter), for the shells of this species having coronate varices.

**Epitonium (Crisposcala) acrostephanum* Dall—34-203 fathoms, in mud, clay and gravel; scarce.

Epitonium (Crisposcala) catalinae Dall—A single specimen from 21 fathoms, in mud, off Monterey (Smith).

Epitonium (Crisposcala) regum Dall—Off Monterey, in 15 fathoms (Burch).

Epitonium (Crisposcala) tabulatum Dall—10-25 fathoms, in fine dark sand and shale fragments, scarce; 43-44 fathoms off Santa Cruz, in soft green mud (USFC Sta. 4482).

JANTHINIDAE

Janthina bifida Reeve—Pelagic. Rarely washed ashore on sandy beaches during winter storms. Has been incorrectly called *J. exigua* Lamarck, which is a species originally described without locality information but generally considered to have a wide distribution.

Janthina globosa Swainson—With the preceding; rare (Mrs. Fackenthal).

EULIMIDAE (MELANELLIDAE)

**Balcis berryi* (Bartsch)—10-25 fathoms, in fine dark sand and shale fragments; scarce. *Balcis catalinensis* (Bartsch)—25 fathoms, in sand off Carmel; rare.

**Balcis delmontensis* Smith and Gordon, new species. Described on p. 219; see pl. 3, fig. 5; 10-30 fathoms, in fine dark sand and shale fragments; not common.

Balcis micans (Carpenter)—5-25 fathoms, in sand; fairly common. Sometimes found living commensally on starfish.

**Balcis montereyensis* (Bartsch)—10-15 fathoms, in fine dark sand and shale fragments; rare.

Balcis oldroydi (Bartsch)—10-25 fathoms, with the above; rare.

**Balcis rutila* (Carpenter)—15-25 fathoms, in sand; fairly common. Occasionally found living commensally on starfish.

Balcis thersites (Carpenter)—Shore to 20 fathoms, in sand, kelp holdfasts, and among small rocks and shale fragments; common.

PYRAMIDELLIDAE

Owing to the large number of species comprising the Pyramidellid fauna of Monterey Bay and vicinity, we have followed an arrangement of species in alphabetical order under subgenera. We agree with Willett (1937:402) that in the genus *Turbonilla*, the subgenera *Chemnitzia*, *Strioturbonilla*, and *Pyrgisculus* are weakly defined, and so we follow his arrangement, which is as follows:

Turbonilla (including *Chemnitzia* and *Strioturbonilla*)

Pyrgolampros

Pyrgiscus (including *Pyrgisculus*)

Mormula

Bartschella (including *Dunkeria*)

Turbonillas and *odostomias* generally live on a bottom consisting of a fine dark sand, fragments of shale, and small pebbles or gravel. Unless the habitat of a particular species occurs in a different ecological niche, it will not be repeated in the list. Backs of abalone shells, often accumulated in large heaps on the Monterey Wharf, are an accessible and often prolific hunting ground for *odostomias* and other small species provided the abalone shells are reasonably fresh.

Pyramidella (*Longchaeus*) *adamsi* Carpenter—Monterey (Dall). According to Dall, the single specimen in the National Museum from Monterey is much smaller and slender than the typical form and may prove to be a new species. We have not collected it.

Turbonilla (*Turbonilla*) *asser* Dall and Bartsch—15-25 fathoms; scarce.

Turbonilla (*Turbonilla*) *cayucosensis* Willett—Shore at Pacific Grove; scarce.

**Turbonilla* (*Turbonilla*) *fackenthallae* Smith and Gordon, new species. Described on p. 220; see pl. 3, figs. 7, 8—Dredged in 20-30 fathoms, off Monterey; 3 specimens.

**Turbonilla* (*Turbonilla*) *gabbiana* (Cooper)—Monterey (Cooper). Because the type of this species has evidently been misplaced or lost, it is practically impossible now to tell just what shell Gabb described originally and Cooper subsequently renamed. We suspect, however, that it may be the same as *T. cayucosensis* Willett, though Gabb's description calls for a shell with 23 axial ribs, while *cayucosensis* normally possesses 20 to 22. Syn. *Chemnitzia gracillima* Gabb.

**Turbonilla* (*Turbonilla*) *gilli delmontensis* Dall and Bartsch—10-25 fathoms; rare.

**Turbonilla* (*Turbonilla*) *muricatoides* Dall and Bartsch—15-25 fathoms; rare.

Turbonilla (*Turbonilla*) *santarosana* Dall and Bartsch—25 fathoms; rare.

**Turbonilla* (*Turbonilla*) *serrae* Dall and Bartsch—10-40 fathoms; common.

Turbonilla (*Turbonilla*) *stylina* (Carpenter)—10-40 fathoms; fairly common.

Turbonilla (*Turbonilla*) *torquata* (Gould)—10-30 fathoms; scarce.

[*Turbonilla* (*Pyrgolampros*) *aurantia* (Carpenter)—12 fathoms (Berry); Monterey (Cooper). As we have not collected this Puget Sound species at Monterey we suspect that these records are based on misidentifications.]

[**Turbonilla* (*Pyrgolampros*) *berryi* Dall and Bartsch—39 fathoms off Monterey, in sand; 9-10 fathoms off Santa Cruz, on rocky bottom (USFC Sta. 4564). A study

- of paratypes in the Berry Collection and a suite of specimens from San Pedro leads us to the conclusion that *T. berryi* and *T. painei* Dall and Bartsch are synonyms of *T. chocolata* (Carpenter).]
- Turbonilla* (*Pyrgolampros*) *chocolata* (Carpenter)—Monterey Bay, 8-39 fathoms; Carmel Bay, 20 fathoms; scarce. Syns. *T. berryi* Dall and Bartsch and *T. painei* Dall and Bartsch.
- Turbonilla* (*Pyrgolampros*) *halia* Dall and Bartsch—12-25 fathoms; rare.
- Turbonilla* (*Pyrgolampros*) *halibrecta* Dall and Bartsch—One specimen in 10 fathoms off Del Monte (Smith).
- Turbonilla* (*Pyrgolampros*) *halistrepta* Dall and Bartsch—Two specimens from 10 fathoms off Del Monte seem referable to this species.
- Turbonilla* (*Pyrgolampros*) *lowei* Dall and Bartsch—10-40 fathoms; common.
- Turbonilla* (*Pyrgolampros*) *pedroana* Dall and Bartsch—10-20 fathoms; rare.
- **Turbonilla* (*Pyrgolampros*) *skogsbergi* Strong—5 miles north of Monterey in 28 fathoms, in mud. Also 5 fathoms off Capitola, in sand (W. Williams). A rare species.
- **Turbonilla* (*Pyrgolampros*) *stillmani* Smith and Gordon, new species. Described on p. 221; see pl. 3, fig. 9; 10 fathoms off Del Monte; four specimens.
- Turbonilla* (*Pyrgolampros*) *valdezi* Dall and Bartsch—Shore at Pacific Grove; rare.
- **Turbonilla* (*Pyrgolampros*) *willetti* Smith and Gordon, new species. Described on p. 222; see pl. 3, fig. 10; 10 fathoms off Del Monte; rare.
- Turbonilla* (*Pyrgiscus*) *almo* Dall and Bartsch—5-40 fathoms; scarce.
- Turbonilla* (*Pyrgiscus*) *antestriata* Dall and Bartsch—40 fathoms, in mud (Burch).
- **Turbonilla* (*Pyrgiscus*) *aragoni* Dall and Bartsch—10-30 fathoms; scarce.
- **Turbonilla* (*Pyrgiscus*) *canfieldi* Dall and Bartsch—10-40 fathoms; fairly common.
- **Turbonilla* (*Pyrgiscus*) *castanella* Dall—10-40 fathoms; common.
- **Turbonilla* (*Pyrgiscus*) *delmontana* Bartsch—10 fathoms off Del Monte. Known only from the holotype. Syn. *T. (P.) delmontensis* Bartsch.
- Turbonilla* (*Pyrgiscus*) *mörchi* Dall and Bartsch—One specimen in 25 fathoms off Pacific Grove (Burch).
- Turbonilla* (*Pyrgiscus*) *tenuicula* (Gould)—Shore to 20 fathoms; scarce.
- Turbonilla* (*Mormula*) *tridentata* (Carpenter)—10-40 fathoms; common. Also 20 fathoms in Carmel Bay. (Syn. *T. ambusta* Dall and Bartsch).
- **Turbonilla* (*Bartschella*) *bartschi* Smith and Gordon, new species. Described on p. 222; see pl. 3, fig. 13—Dredged in 25 fathoms off Pacific Grove, in sand. Known only from the type specimen.
- **Odostomia* (*Salassiella*) *heathi* Smith and Gordon, new species. Described on p. 223; see pl. 3, fig. 14—Dredged in 15 fathoms off Pacific Grove. Known only from the type specimen.
- **Odostomia* (*Chrysallida*) *astricta* Dall and Bartsch—5-30 fathoms; fairly common.
- Odostomia* (*Chrysallida*) *clementensis* Bartsch—5-15 fathoms off Point Pinos; one specimen (Smith).
- **Odostomia* (*Chrysallida*) *cooperi* Dall and Bartsch—Shore at Point Pinos, one specimen (Smith); 10-25 fathoms; rare.
- Odostomia* (*Chrysallida*) *lucca* Dall and Bartsch—15 fathoms off Cabrillo Point (Gordon); rare.
- **Odostomia* (*Chrysallida*) *montereyensis* Dall and Bartsch—Shore to 30 fathoms; scarce. This species is very close to *O. cooperi* and the two may be conspecific.
- Odostomia* (*Chrysallida*) *oldroydi* Dall and Bartsch—Shore at Cabrillo Point; 10 fathoms off Del Monte; scarce.
- Odostomia* (*Chrysallida*) *oregonensis* Dall and Bartsch—Shore to 15 fathoms; scarce.
- **Odostomia* (*Chrysallida*) *ornatissima* (Haas)—Washed from sand taken in a tide pool at Point Pinos; two specimens (Haas). In beach drift; rare.

- Odostomia (Chrysallida) trachis* Dall and Bartsch—Monterey (Dall).
Odostomia (Chrysallida) vicola Dall and Bartsch—Beach drift at Pacific Grove; rare. Shore at Point Pinos; one specimen (Smith).
 **Odostomia (Ividella) navisa delmontensis* Dall and Bartsch—10-30 fathoms; rare.
Odostomia (Ivara) turricula Dall and Bartsch—25 fathoms; rare.
Odostomia (Iolaea) amianta Dall and Bartsch—Shore to 30 fathoms; scarce.
 **Odostomia (Menestho) churchi* Smith and Gordon, new species—Described on p. 224; see pl. 3, fig. 12; 25 fathoms off Pacific Grove. Known only from the type specimen.
 **Odostomia (Menestho) exara* Dall and Bartsch—Pacific Grove (Dall and Bartsch); 5-15 fathoms off Point Pinos; scarce (Smith).
Odostomia (Evalea) angularis Dall and Bartsch—Shore to 15 fathoms; rare.
Odostomia (Evalea) californica Dall and Bartsch—10-30 fathoms; fairly common.
 **Odostomia (Evalea) deliciosa* Dall and Bartsch—10-25 fathoms; fairly common.
Odostomia (Evalea) gravida Gould—Monterey (Cooper).
Odostomia (Evalea) inflata Carpenter—Monterey (Cooper).
Odostomia (Evalea) obesa Dall and Bartsch—Between tides; rare.
 **Odostomia (Evalea) phanea* Dall and Bartsch—Low tide to 25 fathoms, on rocks and the backs of red abalones; common.
 **Odostomia (Evalea) tenuisculpta* Carpenter—Shore to 15 fathoms, on rocks and the backs of red abalones; abundant.
 **Odostomia (Evalea) valdezi* Dall and Bartsch—10-25 fathoms; scarce.
 **Odostomia (Amaura) canfieldi* Dall—Shore, in beach drift, to 40 fathoms; scarce.
Odostomia (Amaura) kennerleyi Dall and Bartsch—10-30 fathoms; fairly common.

ATLANTIDAE

Oxygyrus rangi (Lovèn)—Pelagic off Monterey (Dall).

AMPHIPERATIDAE

- Neosimnia barbarensis* Dall—Monterey (Keep, Lowe). One specimen, over an inch long, from fishermen (Berry). According to Schilder (1931, p. 67), this shell is at least a subspecies of *N. loebbeckeana* (Weinkauff).
Neosimnia catalinensis (Berry)—Monterey (Dall). We have not collected it.
Neosimnia inflexa (Sowerby)—20-50 fathoms, on gorgonians; 12 fathoms (Berry). A rather rare species, also to be looked for in the stomachs of fishes taken by set-line fishermen. Syn. *N. variabilis* (C. B. Adams).
 **Neosimnia vidleri* (Sowerby)—30 fathoms, on coral and gorgonians; rare.

PEDICULARIIDAE

Pediculariella californica (Newcomb)—20-50 fathoms, on pink coral. Not often taken, generally only when fishermen bring specimens of the coral that have been snagged by trawl nets or set-lines. Syn. *Pedicularia californica* Newcomb.

CYPRAEIDAE

Cypraea spadicea Swainson—A single specimen in Mrs. Fackenthal's collection, taken alive by her on rocks at low tide, represents the only authentic record from the Monterey region. See Ingram, *Nautilus* 52(1): 1-4, pl. 1, figs. 8-13, 1938. Schilder (1939) classifies this species as *Zonaria spadicea* (Swainson).

ERATOIDAE

- Pusula californiana* (Gray)—Beach drift and living below low tide mark to 40 fathoms, on rocks; fairly common in beach drift but living shells are scarce. This and the following species have until recently been placed in the genus *Trivia*.
Pusula ritteri Raymond—Monterey (Dall).
Erato columbella Menke—Shore, in beach drift, to 20 fathoms; scarce.
Erato vitellina Hinds—Shore to 35 fathoms; fairly common.

RANELLIDAE

- Bursa californica* (Hinds)—10-60 fathoms, on rocks and the shale reefs; fairly common. Occasionally brought in by fishermen.
- Fusitriton oregonensis* (Redfield)—15-60 fathoms; rare. Formerly placed under various related genera, including *Argobuccinum* and *Priene*.

TRIPHORIDAE

- **Triphora montereyensis* Bartsch—Beach drift, and living below low tide mark to 15 fathoms in coarse granite sand, off Pacific Grove; scarce.

CERITHIOPSIDAE

- Cerithiopsis alcina* Bartsch—Off Monterey, in 15 fathoms (Burch).
- **Cerithiopsis berryi* Bartsch—5-30 fathoms, in sand and shale fragments; fairly common.
- Cerithiopsis columa* Carpenter—At low tide, on rocks; rare. Also 10 fathoms off Pacific Grove, in coarse granite sand and pebbles; rare.
- Cerithiopsis cosmia* Bartsch—Beach drift, and at low tide, on rocks; scarce. Also from a red abalone covered with sponge (Burch).
- Cerithiopsis diegensis* Bartsch—At low tide, on rocks in the vicinity of Point Pinos, common; 25 fathoms, rare.
- **Cerithiopsis fia* Bartsch—Shore to 25 fathoms; rare.
- **Cerithiopsis ingens* (Bartsch)—58-85 fathoms off Point Pinos, in soft green mud (USFC Sta. 4475). Known only from two specimens.
- **Cerithiopsis montereyensis* Bartsch—Shore, in beach drift and at low tide on rocks, to 25 fathoms; scarce.
- Cerithiopsis rowelli* Bartsch—25 fathoms, Monterey and Carmel Bays, in sand; rare.
- **Cerithiopsis santacruzana* Bartsch—3-30 fathoms, on rocks; rare.
- **Cerithiopsis tumida* (Bartsch)—Shore, collected by Canfield and Stearns (Bartsch). We have not collected this species.
- Scila montereyensis* Bartsch—Living on rocks at low tide, to 30 fathoms; fairly common.
- Metaxia diadema* Bartsch—Shore to 30 fathoms; rare.

CERITHIIDAE

- [*Bittium armillatum* Carpenter—Beach to 20 fathoms (Cooper). We are of the opinion that Cooper's shells were some other species. *B. armillatum* has not been reported from the Bay in recent years and it has not appeared in our dredgings.]
- **Bittium attenuatum* Carpenter—Shore to 20 fathoms; common. Several pretty color forms are found in the beach drift, the more common being one of an all over lavender tone, and another white with a dark brown revolving band at the summit of the whorls. Living specimens are to be sought for at low tide in sand among eel-grass roots.
- Bittium attenuatum multifilosum* Bartsch—With the preceding; rare.
- Bittium eschrichtii iclum* Bartsch—Monterey, Stearns Collection (Bartsch). Shells of this group that we have collected or studied belong to the following subspecies.
- **Bittium eschrichtii montereyense* Bartsch—Shore to 10 fathoms; abundant. Found living in clean coarse granite sand among rocks, at low tide.
- Bittium interfossa* (Carpenter)—Beach drift and at extreme low tide at Point Pinos; scarce.
- Bittium minutum* (Carpenter)—12 fathoms off Del Mon'e, in fine sand and shale fragments (Berry, Smith); rare.
- **Bittium paganicum* Dall—292-356 fathoms off Point Pinos, in soft green mud (USFC Sta. 4508); rare.
- **Bittium purpureum* (Carpenter)—In beach drift and living at low tide among eel-grass roots, to 30 fathoms in sand and shale fragments; fairly common.

- Bittium quadrifilatum* Carpenter—Shore to 40 fathoms, with the preceding species; scarce.
 **Bittium serra* Bartsch—66-69 fathoms off Point Pinos, in green mud and rocks (USFC Sta. 4555); a single specimen. Syn. *Cerithiopsis sassetta* Dall according to Gordon after comparison of the types of both species in the National Museum.
Bittium subplanatum Bartsch—66-73 fathoms off Point Pinos, in green mud and rocks (USFC Sta. 4552); rare.

CAECIDAE

- Caecum californicum* Dall—In beach drift and from 3-30 fathoms, in sand; common.
Caecum licalum Bartsch—10-30 fathoms, in sand; rare.
 [*Caecum quadratum* Carpenter—12 fathoms Berry, on Dall's identification. A doubtful record for this Mazatlan species.]
Micranellum crebricinctum (Carpenter)—10-40 fathoms, in sand; common.
Micranellum oregonense Bartsch—Monterey (Bartsch).
Fartulum occidentale Bartsch—15 fathoms off Pacific Grove, in sand; rare.

VERMETIDAE

- Bivonia compacta* Carpenter—Shore to 25 fathoms, found singly or in contorted masses; fairly common.
Aletes squamigerus Carpenter—Between tides, on shells and rocks; common.
Spiroglyphus lituellus (Mörch)—Shore to 20 fathoms; scarce.
Petalococonchus complicatus Dall—Off Monterey, in 20 fathoms (Burch).
 **Petalococonchus montereyensis* Dall—10-25 fathoms, on rocks and shells; common.
Vermiculium anellum (Mörch)—15-25 fathoms, on shale; scarce.

TURRITELLIDAE

- Turritella cooperi* Carpenter—40-60 fathoms, in mud, sand and gravel; scarce.
Tachyrhynchus lacteolus (Carpenter)—40-63 fathoms, in mud and gravel; scarce.

LITTORINIDAE

- Littorina planaxis* Philippi—At high tide mark, on rocks; abundant.
Littorina scutulata Gould—Between tides, on rocks; abundant.

LACUNIDAE

- **Lacuna marmorata* Dall—On eel-grass, at low tide; abundant.
Lacuna carinata Gould—With the preceding species; abundant. Syn. *L. porrecta* Carpenter.
Lacuna solidula Lovèn—Beach at Point Pinos (Smith, Chace); rare. Santa Cruz (Cooper).
Lacuna unifasciata Carpenter—On broad-leaved eel-grass at Elkhorn Slough; scarce.
Lacuna variegata Carpenter—Monterey (Dall). On algae (Burch).

FOSSARIDAE

- Iselica fenestrata* (Carpenter)—10-30 fathoms, in sand; scarce. Santa Cruz (Cooper).
Iselica obtusa (Carpenter)—5-15 fathoms, in coarse granite sand and boulders; rare.

LITIOPIDAE

- **Alaba serrana* Smith and Gordon, new species. Described on p. 225, see pl. 4, figs. 1, 2; 25 fathoms, in Carmel Bay; two specimens.

RISSOELLIDAE

- **Rissoella hertleini* Smith and Gordon, new species. Described on p. 224; see pl. 3, fig. 15; 10 fathoms, in sand, off Pacific Grove; seven specimens.

BARLEEIIDAE

- Barleeia haliotiphila* Carpenter—In kelp holdfasts. Also, 5-15 fathoms off Point Pinos, in sand and broken shells; fairly common.

- **Barleeia marmorea* (Carpenter)—At low tide, living on rocks, to 25 fathoms; common.
Syn. *Diala marmorea* Carpenter.
- **Barleeia oldroydi* Bartsch—Between tides; abundant. Also in kelp holdfasts. Shore to 15 fathoms (Burch).
- Barleeia subtenuis* Carpenter—From brackish spring; Carmel only (Cooper).
- Diala acuta* Carpenter—Shore, under rocks at low tide, to 20 fathoms; common.

RISSOIDAE

- **Cingula montereyensis* Bartsch—5-15 fathoms off Point Pinos; rare.
- Amphithalamus tenuis* Bartsch—Shore to 10 fathoms, in sand; rare.
- Alvania acutelirata* (Carpenter)—5-30 fathoms, in sand; common.
- **Alvania californica* Bartsch—Monterey (Bartsch). We have not collected it.
- Alvania compacta* (Carpenter)—15 fathoms, in sand; rare.
- Alvania carpenteri* Weinkauff—Monterey, Oldroyd (Burch).
- [*Alvania filosa* Carpenter—"Monterey. 'From shell washings.' Carpenter's list." (Cooper).
Possibly a pathologic mutation, according to Bartsch.]
- Alvania oldroydae* Bartsch—Beach drift, at Pacific Grove; one specimen (Gordon).
- **Alvania purpurea* Dall—Low tide, living on rocks, to 30 fathoms, in sand; fairly common.
- Alvania rosana* Bartsch—25 fathoms, in sand, Carmel Bay; common with *A. acutelirata* Dall.
- **Alvania trachisma* Bartsch—Monterey (Bartsch). Not collected recently.
- Alvania (Willettia) aequisculpta* Keep—Beach drift at Pacific Grove; rare.
- **Alvania (Willettia) montereyensis* Bartsch—Under rocks at low tide; fairly common.
- **Alvania (Willettia) microglypta* Haas—Point Pinos, washed from sand in a tide pool (Haas). From the published figure and size of the shell we suspect it is not an *Alvania* but possibly the broken tip of a *Bittium*.

RISSOINIDAE

- Rissoina bakeri* Bartsch—10-30 fathoms, in sand; scarce. Most of the specimens we have seen from Monterey Bay are quite variable and few are typical. They appear to belong to this species, however.
- **Rissoina hannai* Smith and Gordon, new species. Described on p. 226; see pl. 4, fig. 4; 25 fathoms, in sand, Carmel Bay; 28 specimens.
- **Rissoina keenae* Smith and Gordon, new species. Described on p. 227; see pl. 4, fig. 3; 5-15 fathoms off Point Pinos, in coarse sand and broken shells; three specimens.
- Rissoina newcombei* Dall—Off Monterey, in 15 fathoms, on shale (Burch).

ASSIMINEIDAE

- Assiminea translucens* (Carpenter)—Elkhorn Slough, in *Salicornia*; fairly common. Syn. *Synccera translucens* (Carpenter).

HIPPONICIDAE

- Hipponix antiquatus* (Linnaeus)—In colonies, under rocks at low tide; common.
- [*Hipponix antiquatus cranioides* Carpenter—With the preceding. In our opinion, this subspecies is of doubtful standing, as *H. antiquatus* varies considerably to fit the locations where it grows.]
- [*Hipponix serratus* Carpenter—Monterey (Dall). A doubtful record of this southern species.]
- Hipponix tumens* Carpenter—Living at low tide, on rocks, to 20 fathoms; fairly common.

CREPIDULIDAE

- Crepidula aculeata* (Gmelin)—Monterey (Cooper). This species normally lives to the south of Monterey, although Burch has recently reported having collected it in the Bay.

- **Crepidula adunca* Sowerby—Shore to 20 fathoms, on rocks and shells; common.
- Crepidula excavata* (Broderip)—Monterey (Dall). Although we know of no recent authentic records for this shell in the Monterey region, it should occur there, having been collected both to the north and the south.
- [*Crepidula onyx* Sowerby—Monterey (Dall). We have neither seen nor collected unquestioned specimens of this species at Monterey and believe Dall's record to be a doubtful one.]
- Crepidula perforans* (Valenciennes)—At low tide, under rocks and in the apertures of the larger gastropod shells inhabited by hermit crabs; common. *C. excavata* Nuttall, described from Monterey, is a synonym. We believe that *C. fimbriata* Reeve is merely a situs form, and use *perforans* as it is the oldest name for this variable shell. *C. nummaria* Gould is a different species, easily separable from the other white California crepidulas by its heavy golden-brown periostracum. We have found no authentic records of *nummaria* from the Monterey region although it should occur there. Monterey records for *C. navicelloides* Sowerby published by Keep and others should probably be referred to *perforans*. *C. nivea* C. B. Adams, which was described originally from Panama, has not certainly been reported from as far north as Monterey Bay.
- Crepidatella lingulata* (Gould)—Living at low tide, under rocks and on shells, to 40 fathoms on shale rocks and stones; abundant. Syn. *Crepidula lingulata* Gould.
- Crepidatella orbiculata* (Dall)—52-55 fathoms off Point Pinos, on rock; two specimens (Gordon). These and two other specimens examined show evidences of a nuclear sculpture consisting of extremely fine, sharp, spiral lirae, which scale off easily and may not be present on some adult shells. We suspect that *Verticumbo charybdis* Berry, from the lower Pleistocene of San Pedro and about 50 fathoms off Redondo, California, is a close relative of *C. orbiculata* if the two species are not actually conspecific. Syn. *Crepidula orbiculata* Dall.

CALYPTRAEIDAE

- [*Crucibulum spinosum* (Sowerby)—Monterey; nine specimens (Wood: 1893). This is not a species of the Monterey fauna. Wood's record is the only one known and must be considered doubtful until confirmed by other collectors.]
- **Calyptrea burchi* Smith and Gordon, new species. Described on p. 227; see pl. 4, figs. 11-13; 15-40 fathoms, on shale; scarce. Carmel (CAS Collection).
- **Calyptrea contorta* (Carpenter)—15-40 fathoms, on shale; rare. Distinguished from young shells of the preceding species by a white instead of a yellow nucleus.
- [*Calyptrea fastigiata* Gould—8-20 fathoms (Cooper). We have not collected this Puget Sound shell at Monterey and believe Cooper's shells may possibly have been *C. burchi*].

NATICIDAE

- Natica clausa* Broderip and Sowerby—389-871 fathoms off Point Pinos and mouth of Salinas River, in green mud and sand (USFC Stas. 3670, 4513, 4517, 4538, 4540); fairly common.
- **Polinices acosmitus* (Dall)—627 fathoms off Point Pinos, in blue mud (USFC Sta. 3128); rare.
- Polinices caurinus* (Gould)—278-581 fathoms off mouth of Salinas River, in green mud and sand (USFC Stas. 3669, 3670). 500 fathoms off Monterey, from fishermen; one specimen (Gordon). A scarce species in the Bay.
- Polinices draconis* (Dall)—12-50 fathoms off Monterey, in mud and fine sand; fairly common. Generally taken in deeper water than *P. lewisii* (Gould).
- Polinices groenlandicus* (Möller)—296 fathoms off Point Año Nuevo, in fine gray sand (USFC Sta. 3112); 121-766 fathoms off Point Pinos, in green mud and sand (USFC Stas. 4462, 4517); scarce.

Polinices lewisii (Gould)—Below low tide to 25 fathoms off Monterey, in fine sand.

Also in Elkhorn Slough, in mud; fairly common.

[*Polinices reclusianus* (Deshayes)—Monterey (Dall). A doubtful record for this southern California species. No specimens have been collected recently.]

[*Polinices reclusianus altus* (Dall)—Monterey (Dall). The preceding comment also applies to this subspecies.]

Sinum scopulosum (Conrad)—Below low tide (Mrs. Fackenthal); rare. Syn. *S. californicum* Oldroyd.

Eunaticina oldroydii (Dall)—30-70 fathoms, in mud; fairly common. Sometimes brought in by fishermen operating drag boats for flat-fish. A large specimen in the Stanford University Collection, taken in the Bay, measures: height, 81.3; width, 71.5; height of aperture, 63.5 mm.

LAMELLARIIDAE

**Lamellaria rhombica* Dall—Low tide to 15 fathoms off Pacific Grove; rare.

**Lamellaria stearnsii* Dall—At low tide, under rocks; scarce. The subspecies *orbiculata* Dall is found with the typical form and appears to have no value taxonomically.

VELUTINIDAE

**Velutina granulata* Dall—28-35 fathoms off Point Pinos, in black mud, sand, and shells (USFC Sta. 4441); known only from the type specimen.

Velutina laevigata (Müller)—Low tide to 12 fathoms, under rocks and on shale; fairly common.

[*Velutina prolongata* Carpenter—Monterey (Dall). Dall's specimen in the National Museum looks like an abnormal *V. laevigata*. The record must remain doubtful until confirmed.]

[*Velutina zonata* Gould—Monterey (Dall). As this is the only record for the species south of the Pribilof Islands it is in need of confirmation.]

ACMAEIDAE

Acmaea asmi (Middendorff)—Between tides, generally on the base or periphery of living shells of *Tegula funebris* (A. Adams); common.

[*Acmaea depicta* (Hinds)—One doubtful Monterey record (Ricketts). We have seen no authentic specimens from the region.]

Acmaea fenestrata cribraria Carpenter—Monterey (Test). Appears to be a scarce form in the Bay.

Acmaea digitalis Eschscholtz—Between tides, on rocks; common. Syns. *A. textilis* Gould, and *umbonata* Reeve.

**Acmaea funiculata* (Carpenter)—5-35 fathoms off Pacific Grove and Point Pinos; also 25 fathoms in Carmel Bay. This species is rare and we have taken only one live specimen. Young shells of *A. mitra* Eschscholtz from the Monterey region show no tendency toward intergradation with *funiculata*.

Acmaea insessa (Hinds)—Between tides, living on "ribbon" kelp *Egregia menziesii* Aresch.; common.

Acmaea instabilis (Gould)—At low tide, living on the round, stiff stalks of the alga *Laminaria andersonii* Farlow; scarce.

Acmaea limatula Carpenter—Between tides, on rocks; common. *A. limatula mörchii* Dall, a single specimen of which was collected at Elkhorn Slough, is not a good subspecies but merely an ecologic variant according to Mrs. Test (1945:405).

Acmaea mitra Eschscholtz—Low tide, on rocks and in deep tide pools, to 20 fathoms. Dredged specimens are generally young. This shell is the common "White Cap" found on the beaches.

- **Acmaea ochracea* (Dall)—Living on smooth stones or boulders at extreme low water; scarce. Syn. *A. peramabilis* Dall.
- Acmaea paleacea* Gould—Living on the blades of the narrow-leaved eel-grass *Phyllospadix torreyi* Watson; fairly common.
- Acmaea pelta* Eschscholtz—Between tides, on rocks; abundant. *A. cassis nacelliodes* (Dall) is considered to be merely a situs form of young *pelta* commonly found living on kelp holdfasts. Other synonyms are: *A. cassis* Eschscholtz, *monticola* Dall, *olympica* Dall, *pintadina* Gould, and var. *hybrida* Shepard (Naut., 9:72, 1895).
- Acmaea persona* Eschscholtz—Between tides, on rocks; scarce. Burch (Minutes, So. Calif. Conch. Club, No. 57, p. 10, Feb. 1946) cites *A. persona strigatella* Carpenter with a range extending north to Monterey, but there is some question whether this subspecies is a valid one.
- Acmaea rosacea* Carpenter—Low tide to 35 fathoms, living on rocks and shale; fairly common. Dead shells of this species are often found in beach drift.
- Acmaea scabra* (Gould)—Between tides, on rocks; common. Syn. *A. spectrum* Reeve.
- Acmaea scutum* Eschscholtz—Between tides, on rocks; abundant. Cited as a subspecies of the circumboreal *A. testudinalis* (Müller) by Mrs. Test. Syns. *A. patina* Eschscholtz, *pintadina* (Gould), *parallela* Dall, and *emydia* Dall.
- **Acmaea triangularis* (Carpenter)—Low tide to 30 fathoms, generally living on the pinkish calcareous alga *Amphiroa tuberculosa* Decaisne but occasionally on rocks and shale; fairly common. The method used by the Chaces in collecting this small limpet in quantity is to obtain a pailfull of the alga and allow it to stand over night in fresh water. Subsequent washing and shaking cause the limpets to drop off and sink to the bottom of the pail, where they may be gathered with ease.
- Lottia gigantea* Sowerby—Between tides, on rocks, especially along the ocean front. We include *L. gigantea albomaculata* Dall as a synonym on the basis that this is merely a color form. "Owl" limpets have been so much sought after that fine full-grown specimens are now hard to find where they were once common. Immature shells are still to be commonly collected.

PHASIANELLIDAE

- [*Phasianella compta* Gould—Monterey (Berry, on Dall's identification). See *P. substriata* (Carpenter). According to Strong (1928, p. 192), this species does not appear to range as far north as Monterey.]
- Phasianella pulloides* Carpenter—Low tide to 20 fathoms; abundant. Santa Cruz, living at low water (Cooper).
- Phasianella rubrilineata* Strong—Shore to 15 fathoms; scarce. Fresh living shells are sometimes sculptured with exceedingly fine, closely-spaced striations that are visible only under proper light with fairly high magnification.
- [*Phasianella substriata* (Carpenter)—Shore to 15 fathoms (Berry). All specimens of the subgenus *Eulithidium* from Monterey that we have examined are imperforate and belong to the preceding species. A re-examination of Berry's shells by him and A. M. Strong showed that they are *P. pulloides* Carpenter, as are also the shells reported from Monterey on U. S. National Museum authority as *P. compta* Gould and *Eucosmia variegata* Carpenter.]

TURBINIDAE

- Astraea inaequalis* (Martyn)—Low tide to 35 fathoms, on rocks and shale; common inshore at certain times of the year. Syn. *A. inaequalis montereyensis* Oldroyd.
- Homalopoma baculum* (Carpenter)—Between tides, under rocks; common. Syn. *Leptothyra bacula* Carpenter.
- Homalopoma carpenteri* (Pilsbry)—Low tide to 20 fathoms, under rocks and on shale; abundant. Syn. *Leptothyra carpenteri* Pilsbry.

- **Homalopoma paucicostatum* (Dall)—Living at low tide, under rocks, to 15 fathoms, in sand and broken shells; fairly common. Syn. *Leptothyra paucicostata* Dall.
- Homalopoma paucicostatum fenestratum* (Bartsch)—With the preceding. Shells referred to the subspecies are but weakly differentiated from the typical. These may not be good examples, however, as Berry believes that *fenestratum* is distinct enough to warrant raising it to specific rank.

LIOTIIDAE

- Liotia fenestrata* Carpenter—Beach drift, and living at low tide, under rocks; scarce.
- Arene acuticostata* (Carpenter)—Shore to 15 fathoms; rare. Syn. *Liotia acuticostata* Carpenter.

TROCHIDAE

- Norrisia norrisi* (Sowerby)—One young specimen taken in 12 fathoms by Berry, which appears to be the only authentic Monterey record of this southern species.
- **Halistylus pupoides* (Carpenter)—10-40 fathoms, in sand and shale fragments; common. Syn. *H. subpupoides* (Tryon).
- Tegula brunnea* (Philippi)—Between tides, on rocks and ribbon kelp; off shore in the kelp beds on the fronds near the surface; abundant. This species lives a little farther out than *T. funebris* (A. Adams), with good living specimens generally found only at extreme low tide. A subspecies, *T. brunnea fluctuosa* (Dall), has been described but at best it is only a weakly differentiated form having doubtful taxonomic value.
- Tegula funebris* (A. Adams)—On and under rocks between tides; abundant. We include the subspecies *T. funebris subaperta* (Carpenter), there being a question on its valid standing.
- [*Tegula gallina* (Forbes)—Monterey (Dall). Dall's specimens in the National Museum are correctly identified, yet we know of no recent authentic record of this southern species from the Monterey region. The record needs confirming.]
- [*Tegula ligulata* (Menke)—The preceding comment also applies to this species.]
- Tegula montereyi* (Kiener)—On kelp fronds at low tide; scarce. The finest specimens have been collected by searching the offshore kelp beds in a boat, where it occurs with *T. brunnea* but generally farther down the stalks. A large specimen taken in this habitat measures: height, 40.0; major diameter, 43.2 mm. (AGS No. 242).
- Tegula pulligo* (Martyn)—With the above, but scarcer. Young specimens, brilliantly maculated with lavender and brown, are occasionally taken alive under rocks at low tide and dredged down to 15 fathoms on the shale bed. It is possible that true *pulligo* is a northern race with a rounded basal periphery (syn. *T. pulligo taylori* Oldroyd), and that the Monterey shells with a sharply keeled periphery may be *T. marcida* (Gould).
- Calliostoma annulatum* (Martyn)—Found sparingly on the fronds of the giant kelp, off shore. In 1913, accompanied by Mrs. Fackenthal, the senior author collected fine large specimens in considerable quantity off Pacific Grove in July, following several warm, quiet, sunny days during which the calliostomas has evidently crawled up the kelp stems from deeper down. Young, brilliantly marked specimens have been dredged on the shale in 8-15 fathoms off Del Monte. A scarce species. *C. annulatum* is without doubt one of the most beautiful among the mollusks in the Monterey region.
- Calliostoma canaliculatum* (Martyn)—On kelp, off shore, with *C. annulatum*, *C. costatum* (Martyn), *Tegula brunnea*, *T. montereyi*, and *T. pulligo*; sometimes abundant. Young specimens occasionally collected alive at low tide, on kelp, and dredged down to 20 fathoms. The color variety *C. canaliculatum nebulosum* Dall, which is found only immature in the Monterey region, appears to have little taxonomic value as a subspecies.

- Calliostoma costatum* (Martyn)—Low tide to 20 fathoms, under rocks and on shale. Fine, large specimens occasionally collected off shore on the fronds of the giant kelp, well down on the stalks. On shore it is a common species. With the typical form we include the color varieties *C. costatum caeruleum* Dall and *C. costatum pictum* Dall.
- **Calliostoma gloriosum* Dall—3-20 fathoms, on rocks and shale; scarce.
- Calliostoma platinum*. Dall—198-495 fathoms off Point Pinos, in green mud, coarse sand, and shells (USFC Sta. 4515); 120 fathoms (Oldroyd); 220 fathoms off Monterey, on rock (Hopkins Marine Laboratory). Brought up by set-line fishermen from about 200 fathoms off Davenport, Santa Cruz County, when a small species of anemone growing on the shells attaches itself to the baited hooks; four specimens, of which the largest measures: height, 39.0; major diameter, 35.5 mm. (Strohbeen). A rare species.
- Calliostoma splendens* Carpenter—Shore to 40 fathoms, on rocks and shale; scarce. This pretty species is sometimes difficult to distinguish from the young of *C. costatum*. In sculpture, it is closer to the southern *C. supragranosum* Carpenter, but is much darker in color.
- [*Calliostoma supragranosum* Carpenter—Monterey and Santa Cruz, dredged (Cooper). Low tide to 12 fathoms (Berry, on Dall's identification). We have seen no typical specimens from the Monterey region. It is possible that shells under this name from Monterey belong to the preceding species.]
- Calliostoma tricolor* Gabb—10-40 fathoms, on rocks and shale; scarce.
- Calliostoma variegatum* Carpenter—Young specimens dredged in 15-20 fathoms; rare.
- **Turcica coffea* Gabb—10-35 fathoms off Monterey, on shale. Also found occasionally in kelp holdfasts; scarce.
- Turricula bairdii* Dall—418-581 fathoms off Point Pinos, in mud and sand (USFC Stas. 3127, 3670). Apparently a common shell at this depth range.
- Cidarina cidaris* (A. Adams)—53-93 fathoms off Point Pinos, in hard sand, green mud and rocks (USFC Stas. 4543, 4552); rare.
- Solariella nuda* Dall—278-627 fathoms off Point Pinos and mouth of Salinas River, in sand and mud (USFC Stas. 3128, 3669); 298 fathoms off Point Sur (USFC Sta. 3187); scarce.
- Solariella peramabilis* Carpenter—40 fathoms, on shale; rare. Carmel Bay in 20 fathoms (Cooper).
- Margarites acuticostatus* (Carpenter)—Shore (beach drift) to 12 fathoms, in sand and shale fragments; fairly common. Some of our specimens approach Dall's figure (USNM Bull. No. 112, pl. 18, fig. 5) but may belong to the variable *M. optabilis* (Carpenter).
- **Margarites keepi* Smith and Gordon, new species. Described on p. 228; see pl. 4, figs. 5-7; 25 fathoms off Cabrillo Point, in sand; five specimens.
- Margarites lirulatus* (Carpenter)—Shore, at low tide among rocks and gravel, to 15 fathoms; abundant.
- Margarites optabilis* (Carpenter)—Rare in beach drift. Living from 5-15 fathoms in coarse sand and rocks and also in fine sand and shale fragments; common.
- Margarites parcipictus* (Carpenter)—Shore, on rocks and among algae and seaweed everywhere; abundant. Dredged down to 40 fathoms.
- [*Margarites pupillus* (Gould)—Beach to 20 fathoms (Cooper). This typical northern species does not appear to live in the Monterey region. Cooper's specimens may have been confused with the following species.]
- **Margarites salmoneus* (Carpenter)—Low tide, under rocks, to 20 fathoms; common.
- **Margarites smithi* Bartsch—Shore at Pacific Grove; one specimen (Smith). The type lot of nine specimens was dredged in 10 fathoms off China (Cabrillo) Point (Smith).
- Margarites succinctus* (Carpenter)—Low tide to 20 fathoms; abundant.

[**Gibbula canfieldi* Dall—Monterey, dead on the beach (Dall). Known for certain only from the type specimen. We have diligently sought for this species without success, and suspect it may be adventitious.]

VITRINELLIDAE

**Vitrinella berryi* Bartsch—8-12 fathoms off Del Monte, in sand and shale fragments; rare.

Vitrinella eschnauri Bartsch—12 fathoms (Berry).

Vitrinella oldroydi Bartsch—Fairly common living on the mantles of *Ischnochiton heathiana* Berry—15 fathoms off Pacific Grove, in fine dark sand and shale fragments; rare.

**Vitrinella stearnsi* Bartsch—5-15 fathoms off Point Pinos, in clean granite sand, and off Del Monte, in fine sand and shale fragments; rare.

Skenca californica (Bartsch)—10-30 fathoms, in fine dark sand and shale fragments; rare. This may prove to be the same as *D. coronadoensis* Arnold. Syn. *Cyclostremella californica* Bartsch.

**Skenca carmelensis* Smith and Gordon, new species. Described on p. 229; see pl. 4, figs. 8-10; 25 fathoms, in sand, in Carmel Bay; rare.

Scissilabra dalli Bartsch—8-10 fathoms off Del Monte and 15 fathoms off Soquel, in fine muddy sand; scarce.

Tenostoma invallatum (Carpenter)—Monterey (Dall). A single specimen from the mantle of *Ischnochiton heathiana* Berry. 5 miles south of Carmel (Gordon).

Tenostoma supravallatum (Carpenter)—Monterey (Dall). We have not collected it.

HALIOTIDAE

Haliotis assimilis Dall—2 small but full-grown shells and one immature shell from the beach at Seaside (Gordon). One full-grown shell from the beach at Carmel (Smith). Several specimens from about 10 fathoms off Yankee Point, south of Carmel (Sorensen), which Bartsch has recently described as *H. aulaea*. Until lately this species has not been well known from the Monterey region although reported as having been taken from as far north as the Farallone Islands. Mr. A. Sorensen writes: ". . . I learned that a young Japanese abalone diver had brought in several *H. assimilis* and *H. wallalensis*. . . He said he was getting them from Yankee Point south, in deep water, 10 to 18 fathoms. He had been out to about 20 fathoms, but there were no *H. rufescens* deeper than about 12 fathoms, while there were no *H. assimilis* and *H. kamtschatkana* inside of 8 to 12 fathoms. Hence the abalone divers know them generally as 'deep sea' abalones." Specimens of *H. assimilis* from the Monterey region are lower arched and less corrugated in sculpture than typical shells of the species from southern California. Some of the younger specimens show a remarkable resemblance to *H. kamtschatkana* Jonas and it is sometimes difficult to distinguish them from this latter species. Based on the material we have seen so far we are of the opinion that *H. aulaea* Bartsch should be considered as a synonym, at least until the anatomical relationships have been worked out.

[*Haliotis corrugata* Gray—Monterey (Dall). We have seen no authentic specimens of this species from the Monterey region. The record is in need of confirmation.]

Haliotis cracherodii Leach—At low tide, under rocks and in rock crevices; common. Fine large specimens are now hard to find.

Haliotis fulgens Philippi—The California Academy Collection contains a lot of 8 shells, which appear to be this species, collected by Hemphill at Monterey (C.A.S. No. 29161). These are all small, the largest being about $2\frac{3}{4}$ inches in length. Two other similar shells have been collected by Gordon at Point Lobos. Shells with the animal in alcohol are needed to prove whether this is a depauperate race of *fulgens* or another and possibly new species. Wood recorded one specimen of *fulgens* from

Monterey in 1893. Keep (1896) says: "The only live one I ever saw was an aged specimen which was found on the rocks at Cypress Point. Monterey Bay seems to mark its extreme northern location, and even then I have never found a specimen in the Indian shell-heaps, though *rufescens* and *Cracherodii* are found by the thousands in all stages of decomposition."

Haliotis kamtschatkana Jonas—A few specimens of small size are occasionally washed on shore after winter storms (Sorensen); 10-15 fathoms, on shale, dead shells only, rare; taken sparingly by abalone divers from about 10-20 fathoms off Yankee Point, south of Carmel (Sorensen). A single young specimen, dredged on the shale in 35 fathoms, is provisionally assigned to this species.

Haliotis rufescens Swainson—Low tide, under rocks and in rock crevices, to about 12 fathoms. Once abundant along the rocky shores from Monterey to Point Pinos and along the ocean front from there south, the red abalone of commerce is now hard to find in adult sizes of legal dimensions. The commercial aspects have been discussed elsewhere in this paper.

Haliotis wallalensis Stearns—The "Sunset Abalone" is rarely taken in the Monterey region although it is not uncommon at extreme low water north of Point Reyes and along the Mendocino County coast. The California Academy Collection has two shells collected at Monterey by Hemphill (C.A.S. No. 15107), the largest measuring about 3 inches in length. Four specimens have been taken by an abalone diver in about 10 fathoms off Yankee Point (Sorensen). The southern range of *wallalensis* has recently been extended to Point Buchon, just south of Morro Bay, in San Luis Obispo County (Sorensen).

FISSURELLIDAE

Fissurella volcano Reeve—Low tide and in deep tide pools, to 20 fathoms, on rocks; common. The color form *F. v. crucifera* Dall, which we believe should have no standing as a subspecies, is found rarely with the typical form. Syn. *Hemitoma golicshae* (Dall).

**Megathura crenulata* (Sowerby)—Low tide to 5 fathoms, on rocks. Giant key-hole limpets appear to have become less common in recent years.

**Megatebennus bimaculatus* (Dall)—Low tide to 20 fathoms, especially in rock crevices and under rocks; fairly common.

[*Lucapinella callomarginata* (Dall)—Monterey (Stearns). Dall believed that a living specimen collected by Stearns might be this species. It is a shell found farther south than Monterey. The record seems doubtful.]

Diodora aspera (Eschscholtz)—Shore, under rocks, to 20 fathoms, on shale; common. A large specimen in the Berry Collection measures: length, 88.8; width, 60.3 mm. The subspecies *D. aspera densiclathrata* (Reeve) was said by Cooper to be found in deeper water, but those we have dredged appear to be more delicately sculptured, young specimens of the typical form. Cooper also reported that the animal differs from *aspera* but we suspect he may have confused his shells with *D. murina*. Syn. *D. aspera densiclathrata* (Reeve).

Diodora murina (Dall)—Beach drift; fairly common. Living, 5-35 fathoms off Pacific Grove and Monterey, on rocks and shale; only occasionally taken alive.

Puncturella cooperi Carpenter—10-25 fathoms, on shale; scarce.

Puncturella cucullata (Gould)—10-40 fathoms, on rocks and shale; fairly common.

Puncturella galeata (Gould)—52-55 fathoms off Point Pinos, on rock; one specimen (Gordon).

**Hemitoma bella* (Gabb)—Young dead shells and fragments dredged in 5-20 fathoms off Point Pinos, in clean granite sand and broken shells; also, 15 fathoms off Del Monte, on shale. Two large specimens in 20 fathoms (Burch). Although several

beach-worn specimens of this scarce species have been found, all of the few fine living specimens have been brought in by fishermen. The type specimen of *bella*, an immature dead shell in the collection of the University of California at Berkeley, is shown on pl. 4, figs. 14-16. There appears to be but one species of *Hemitoma* from the California coast, *H. yatesii*, which was also described from Monterey Bay, being merely the adult stage of *bella*. There are several specimens in the original lot obtained from fishermen by J. K. Oliver, a curio dealer in Monterey. In addition to the type in the National Museum, another is on display in the Pacific Grove Museum, and a third is in the Berry Collection in Redlands, California. Syn. *H. yatesii* (Dall).

AMPHINEURA

POLYPLACOPHORA

LEPIDOPLEURIDAE

[*Leptochiton ambustus* (Dall)—12 fathoms off Del Monte, on shale fragments (Berry, on Dall's identification). This record needs confirming as the specimens dredged by Berry are quite likely to be *L. heathi* Berry.]

Leptochiton cancellatus (Sowerby)—20-50 fathoms, on rocks and shale (Burch, Gordon, A. G. Smith). Off Point Joe, Monterey Peninsula, in 65 fathoms, from fishermen (Hunter). Scarce. The deeper-water leptochitons from the Monterey region have somewhat stronger sculpture than typical *cancellatus* from Puget Sound and are referred to this species with some doubt.

**Leptochiton heathi* (Berry)—10-35 fathoms off Monterey, on shale; common.

[*Leptochiton nexus* Carpenter—Pacific Grove (Heath, on Pilsbry's identification). The record needs confirming.]

**Leptochiton oldroydi* (Dall)—25 fathoms; rare (Gordon).

Leptochiton rugatus (Pilsbry)—At low tide or in deep tide-pools, under rocks buried in sand; fairly common.

Oldroydia percrassa (Dall)—12-40 fathoms, on shale; scarce.

[*Hanleya hanleyi* (Bean)—Monterey (Dall). May refer to the following species.]

**Hanleya spicata* Berry—33 fathoms off Point Pinos, on a rock ledge (Heath). Known only from the type specimen.

LEPIDOCHITONIDAE

Tonicella lineata (Wood)—In tide pools and at low tide, to 35 fathoms; common. Specimens from the Monterey region are not as large and fine as those living along the Mendocino County coast. The color markings on this species are quite variable. Specimens from deeper water are quite small.

Tonicella ruber (Linnaeus)—12 fathoms; one specimen (Berry, on Dall's identification). Not collected recently.

Tonicella submarmorca (Middendorff)—Off Monterey, in 10 fathoms (Burch); a single small specimen. The occurrence of this minutely granulated northern species in the Bay is the occasion for some surprise.

**Cyanoplax fackenthallae* Berry—Shore at Pacific Grove (Mrs. Fackenthal). It has been found living sparingly in the holdfasts of ribbon kelp at low tide in the "Great Tide Pool" near Point Pinos, on the ocean side. It mimics the kelp roots in color so closely that it is easily overlooked. Discovery of the habitat of *fackenthallae* is due to the efforts of the Rev. Elwood B. Hunter and Mr. and Mrs. Emery P. Chace. The species is very closely related to *C. lowei* (Pilsbry), a southern California form.

**Cyanoplax hartwegii* (Carpenter)—Between tides, on rocks hidden under seaweed, to 5 fathoms; common. The subspecies *C. h. nuttalli* (Carpenter) has now been recognized as the young stage and therefore is not separable from the typical form.

- Cyanoplax raymondi* (Pilsbry)—Found with the above, and also on the backs of red abalones; fairly common.
- Nuttallina californica* (Reeve)—Between tides on rocks, generally along the ocean front; abundant.
- **Nuttallina thomasi* Pilsbry—Between tides, on rocks and in small tide pools at Pacific Grove, Cypress Point, Pescadero Point, and Point Lobos (Heath, Gordon); rare.

MOPALIIDAE

- Basiliochiton flectens* (Carpenter)—12-20 fathoms, on shale off Monterey; scarce.
- **Basiliochiton heathii* (Pilsbry)—Low tide to 17 fathoms; scarce. Rare under rocks at low water mark and only occasionally collected in deeper water.
- [*Dendrochiton gothicus* (Carpenter)—Monterey (Dall). A doubtful record for this southern California species. We have not collected it in the Bay.]
- **Dendrochiton thamnopus* (Berry)—Low tide, under rocks, Point Pinos and Carmel; 10-40 fathoms off Del Monte, on shale; scarce.
- Mopalia acuta* (Carpenter)—10-35 fathoms off Del Monte, on shale fragments; scarce. This species is not closely related to *M. muscosa* Gould, at least in the Monterey region and so we show it as a separate species.
- Mopalia ciliata* (Sowerby)—At low tide, under rocks, in rock crevices, and caves; fairly common. In the Monterey region this species exhibits a puzzling variation in shape, girdle armature, and color markings. Small to medium-sized specimens, usually marked with brilliant red or occasionally entirely red, have been dredged down to 35 fathoms. Along with these are found small, high-arched, red-marked chitons that are related to *ciliata* and may be a separate species. Adequate identification of this and perhaps of other related Monterey forms depends upon a thorough study of the group.
- Mopalia ciliata vosnessenskii* (Middendorff)—12 fathoms; one specimen (Berry).
- Mopalia hindsii* (Reeve)—At low tide, on and under rocks; common in favorable locations, where it grows very large. In the Monterey region, *hindsii* is quite different from *M. muscosa* (Gould) and we have seen no intergrades between the two.
- Mopalia imporcata* Carpenter—10-25 fathoms off Monterey and Del Monte, on shale fragments; scarce.
- Mopalia lignosa* (Gould)—Between tides, on and under rocks; fairly common. Apparently does not intergrade with *muscosa*.
- Mopalia muscosa* (Gould)—Between tides, on rocks, generally those covered with seaweed; also in tide pools; common.
- **Mopalia phorminx* Berry—33 fathoms off Point Pinos, on a rock ledge (Heath). Known only from the type specimen.
- Mopalia sinuata* Carpenter—12-35 fathoms, on shale; rare.
- Placiphorella velata* Dall—At low tide, under rocks; immature specimens occasionally found on the backs of red abalones; fairly common.
- Katharina tunicata* (Wood)—Between tides, on rocks, especially those along the ocean front; common.

ACANTHOCHITONIDAE

- Acanthochitona avicula* (Carpenter)—Monterey (Cooper). This old record has been confirmed recently by Burch, who dredged a single specimen in 20 fathoms off Monterey.
- Cryptochiton stelleri* (Middendorff)—At low tide, generally along the ocean front but occasionally in the Bay; scarce. The "Giant Chiton" or "China Abalone" is much less common in the vicinity of Monterey than farther to the north.

CHAETOPLEURIDAE

**Chaetopleura gemma* Dall—Low tide under rocks, to 15 fathoms on shale; common.

ISCHNOCHITONIDAE

[*Ischnochiton (Stenoplax) conspicuus* (Dall)—Monterey (Dall). A doubtful record for this southern species. Occasional immature specimens of *I. heathiana* (Berry) have a rugose sculpture suggesting that of *conspicuus*.]

**Ischnochiton (Stenoplax) fallax* Pilsbry—Low tide at Pacific Grove, Carmel, and five miles south of Carmel, under smooth rocks imbedded in sand; scarce; 10 fathoms (Sorensen). A highly-colored species, of which the major color forms include light yellow-brown, wine-red, and wine-red with green maculations.

**Ischnochiton (Stenoplax) heathiana* (Berry)—Same habitat as the preceding species and found with it; common. Formerly identified as *I. magdalenensis* (Hinds), which Berry (1946a) has shown to belong to a more southern fauna.

**Ischnochiton (Ischnochiton) decipiens* Carpenter—Monterey (Dall). An insufficiently known species that can hardly be identified from Carpenter's meager description. It has probably been described subsequently under other species names.

Ischnochiton (Ischnochiton) interstinctus (Gould)—Monterey (Cooper, Dall). Probably a deeper water species to be dredged in 40 fathoms or more in the Monterey region. We have not collected specimens that can be referred to this name with any certainty.

**Ischnochiton (Ischnochiton) marmoratus* Dall—Pacific Grove (Dall). According to Berry this is probably not an *Ischnochiton* as Dall's description reads more like a species of *Chaetopleura*, close to or identical with *C. gemma* Dall. The type has not been figured.

**Ischnochiton (Ischnochiton) radians* Carpenter—Low tide under rocks, to 35 fathoms, on shale; occasional near shore but common in deeper water. Many color forms of this pretty chiton are to be found, some with white and brown markings, others marked with bright blue.

**Ischnochiton (Rhombochiton) regularis* (Carpenter)—At low tide under rocks; fairly common.

**Ischnochiton (Lepidozonia) berryi* Dall—10-25 fathoms off Del Monte, on rocks and shale; common. This species seems closely related to *I. sinudentatus* Carpenter and may prove to be a deeper-water analog of it.

[*Ischnochiton (Lepidozonia) californiensis* Berry—Monterey (Keep, Dall), as *I. clathratus* (Reeve). Berry's specimens, determined by Dall, are *I. sinudentatus* Carpenter and Keep's record may also be based on this other species. Berry (Proc. Mal. Soc. London, 1915; 255-258, pl. 29, figs. 1, 2, 1931) has shown that true *clathratus* is Lower Californian.]

Ischnochiton (Lepidozonia) catalinae Willett—40 fathoms off Monterey, on shale; a single specimen (Smith). This species seems closely related to *I. willetti* Berry from southern Alaska.

Ischnochiton (Lepidozonia) cooperi Dall—At low tide under rocks, to 25 fathoms on shale; common.

Ischnochiton (Lepidozonia) golischi Berry—Low tide, under rocks at Carmel (Hunter); 12 fathoms off Del Monte, on shale (Smith); 80 fathoms, from fishermen (Berry). The shore specimen collected by Hunter is close to, if not actually *I. sinudentatus* Carpenter. The single specimen from 12 fathoms occurred with a sizeable series of *I. berryi* Dall, from which it differs only in the peculiar color markings. We suspect that *golischi* may be only a rare color variant of *sinudentatus* or *berryi*, or both, which is evidence of the close relationship, if not the identity of these three species. The entire group needs careful working over.

- Ischnochiton (Lepidozona) mertensii* (Middendorff)—Low tide under rocks, to 35 fathoms on shale; common.
- Ischnochiton (Lepidozona) retiporosus* Carpenter—80 fathoms, from fishermen (Berry).
- **Ischnochiton (Lepidozona) sinudentatus* Pilsbry—Low tide under rocks, to 35 fathoms on shale. Scarce on shore but common in 35 fathoms on the shale bed. See remarks under *I. berryi* and *I. golischi*.
- [*Ischnochiton (Lepidozona) veredentiens* Carpenter—Point Año Nuevo (Dall). Berry states that this record is based on poor material and needs confirming.]
- Callistochiton connelleyi* Willett—Low tide in the "Great Tide Pool" near Point Pinos, under rocks; rare (Chace). This may be the young of the following species.
- **Callistochiton crassicosatus* Pilsbry—Low tide under rocks, to 15 fathoms on shale; fairly common.
- [*Callistochiton decoratus punctocostatus* Pilsbry—Monterey (Button). This record for a more southern species needs confirmation. We have not taken it.]
- [*Callistochiton infortunatus* Pilsbry—Monterey (Dall). According to Dr. Berry, the record is unquestionably erroneous.]
- Callistochiton palmulatus* Pilsbry—Low tide under rocks, to 35 fathoms on shale; scarce.
- Callistochiton palmulatus mirabilis* Pilsbry—With the preceding; fairly common.

APLACOPHORA

CHAETODERMATIDAE

- **Chaetoderma montereyense* Heath—39-356 fathoms off Santa Cruz and Point Pinos, mostly in soft mud and sand (USFC Stas. 4485, 4508, 4522, 4523, 4524, 4525); a total of 1555 specimens (Heath).
- **Chaetoderma scabrum* Heath—795-871 fathoms off Point Pinos, in hard gray sand (USFC Sta. 4538); a single specimen (Heath).

CEPHALOPODA

ONYCHOTEUTHIDAE

- Moroteuthis robusta* (Verrill)—Cast on shore near Monterey (Phillips). According to Berry (1910), it was previously reported from Unalaska, the type locality, where one specimen cast on shore had an over-all length of over 14 feet, thus making it the largest mollusk and perhaps even the largest invertebrate known from western North America.
- Onychoteuthis banksii* (Leach)—Monterey Bay (Phillips). Not previously reported by Berry from western North America.

GONATIDAE

- Gonatus* sp., cf. *G. fabricii* (Lichtenstein)—32-1000 fathoms off Point Pinos (USFC Stas. 4468, 4512, 4517, 4530, 4544); seven specimens.

HISTIOTEUTHIDAE

- Calliteuthis (Mcleagroteuthis) heteropsis* Berry—724-1000 fathoms off Point Pinos (USFC Stas. 4538, 4544); two specimens. Previously recorded as *Mcleagroteuthis hoylei* Peffer.

OMNASTREPHIDAE

- Dosidicus gigas* (d'Orbigny)—Occasional in Monterey Bay prior to August, 1935, but common since then.

CRANCHIIDAE

Galiteuthis armata Joubin—780-799 fathoms off Point Pinos (USFC Sta. 4529); one specimen. Syn. *G. phyllura* Berry.

LOLIGINIDAE

Loligo opalescens Berry—Abundant in April, May, and June in Monterey Bay, which is the squid season, with the commercial catch in the Bay averaging from 100 to 150 tons annually (W. L. Scofield).

SEPIOLIDAE

Rossia pacifica Berry—20-142 fathoms at various stations in Monterey Bay dredged by the U. S. Fisheries Commission steamer *Albatross*. It is not unusual for trawl fishermen to bring up this species in their nets. A fairly common squid in the Bay.

CIRROTEUTHIDAE

Cirroteuthis macrope Berry—One specimen taken by Santa Cruz fishermen in September, 1932 (Phillips). The type locality is 2113-2259 fathoms off San Diego (USFC Sta. 4393).

OCTOPODIDAE

Octopus sp., cf. *O. apollyon* Berry—Monterey Bay and along the ocean front; common. According to Berry the name *O. hongkongensis* Hoyle, though previously used for this cephalopod, is not properly applied to the large Pacific Coast species. The main commercial fishing locality is off the rocky shores of the open coast between Point Pinos and Carmel, in 10-30 fathoms (Phillips).

[*Octopus californicus* Berry—Monterey (Keep). A doubtful record for this southern California species.]

Octopus sp., cf. *O. californicus* (Berry)—1006-1041 fathoms off Point Pinos (USFC Sta. 4536); one young specimen. The identity of this octopus with *californicus* is not fully established, according to Dr. Berry.

Octopus leioderma (Berry)—204-239 fathoms off Point Pinos (USFC Sta. 4526); one specimen.

**Octopus pricei* Berry—From the stomach of a salmon off Point Pinos.

Octopus sp.—A young specimen, taken in 50-57 fathoms off Point Pinos (USFC Sta. 4550), has been reported by Berry as probably representing a new species.

ARGONAUTIDAE

Argonauta pacifica Dall—Monterey (Dall). We know of no recent record of the paper nautilus from the Monterey region.

BRACHIOPODA

LINGULIDAE

Glottidia albida (Hinds)—10-40 fathoms, in sand; fairly common.

RHYNCHONELLIDAE

Frieleia halli Dall—659 fathoms off Point Sur, in green mud (USFC Sta. 5699); six specimens.

TEREBRATULIDAE

Terebratulina kiiensis Dall and Pilsbry—52-55 fathoms off Point Pinos, in fine dark sand and pebbles; one dead specimen (Gordon). Also from fishermen in 60 to 80 fathoms; three living specimens (Gordon). 240 fathoms off Watsonville Beach, in black sand and rocks (USFC Sta. 3205?); five specimens.

**Terebratulina unguicula* (Carpenter)—10-40 fathoms, on shale; common at the deeper depths. A large slab of shale, dredged in about 40 fathoms near Humpback Rock, off Monterey, had more than a hundred specimens growing on it. Also 240 fathoms off Watsonville Beach, in black sand and rocks (USFC Sta. 3205?); one specimen.

TEREBRATELLIDAE

Morrisia hornii Gabb—25 fathoms off Carmel, in sand and broken shells, nine specimens; 46-56 fathoms off Point Pinos, in coarse sand, shells, and rocks (USFC Sta. 4551), one specimen. Syns. *Platidia hornii* (Gabb); *Platidia seminula radiata* Dall.

[*Terebratalia occidentalis* (Dall)—Monterey (Cooper, Dall). These are old records that have not been confirmed by recent collecting.]

[*Terebratalia transversa* (Sowerby)—One very worn valve, Monterey (Dall). Lamp shells of this group that we have collected belong to the following subspecies.]

Terebratalia transversa caurina (Gould)—10-40 fathoms, on rocks and shale; fairly common.

Laqueus californianus (Koch)—30-80 fathoms, on rocks; common locally. Also, 861-1062 fathoms off Point Pinos, in hard sand and mud (USFC Sta. 4537); a fragment.

SUPPLEMENTARY LIST

The following 95 species and subspecies, arranged alphabetically by genera, represent possible additions to the preceding list as their ranges along the West Coast, as reported, include the Monterey region although apparently none of them has been collected there. They should be looked for by collectors. Many of them will be found only by deep dredging.

PELECYPODA

<i>Barnea pacifica</i> (Stearns)	<i>Solemya johnsoni</i> Dall
<i>Calyptogena pacifica</i> Dall	<i>Sphenia ovoidea</i> Carpenter
<i>Cardiomya beringensis</i> (Leche)	<i>Thyasira barbarensis</i> (Dall)
<i>Cardiomya oldroydi</i> (Dall)	<i>Thyasira excavata</i> Dall
<i>Lyonsia californica haroldi</i> Dall	<i>Thyasira gouldii</i> (Philippi)
<i>Lyonsiella alaskana</i> Dall	<i>Thyasira trisinuata</i> (d'Orbigny)
<i>Macoma incongrua</i> (von Martens)	<i>Thyasira trisinuata polygona</i> (Jeffreys)
<i>Martesia intercalata</i> Carpenter	<i>Tindaria kennerleyi</i> Dall
<i>Martesia xylophaga</i> (Valenciennes)	<i>Tindaria martiniana</i> Dall
<i>Nucula bellottii</i> A. Adams	<i>Turtonia minuta</i> (Fabricius)
<i>Nuculana minuta</i> (Fabricius)	<i>Vesicomya lepta</i> (Dall)
<i>Nuculana navisa</i> (Dall)	<i>Yoldia cecinella</i> Dall
<i>Pecten alaskensis</i> Dall	<i>Yoldia limatula</i> (Say)
<i>Pecten randolphi</i> Dall	<i>Yoldia martyria</i> Dall
<i>Rocheportia compressa</i> Dall	<i>Yoldia orcia</i> Dall
<i>Rocheportia ferruginosa</i> Dall	<i>Yoldia sanesia</i> Dall
<i>Solemya agassizii</i> Dall	

SCAPHOPODA

<i>Cadulus californicus</i> Pilsbry and Sharp	<i>Dentalium inversum</i> Deshayes
<i>Cadulus stearnsii</i> (Pilsbry and Sharp)	<i>Dentalium watsoni</i> Sharp and Pilsbry
<i>Dentalium dalli</i> Pilsbry and Sharp	

GASTROPODA

- Acmaca persona strigatella* Carpenter
Admete couthouyi gracilior Carpenter
Ancistrolepis californicus Dall
Bittium oldroydae Bartsch
Carinoturris pernodata (Dall)
Carinoturris polycaste (Dall)
Chaetopleura beanii (Carpenter)
Cingula californica (Tryon)
Clio occidentalis (Dall)
Cocculina agassizii Dall
Colus adonis Dall
Colus halimeris (Dall)
Colus hallii (Dall)
Crepidula nummaria Gould
Diala exilis (Tryon)
Epitonium caamanoi (Dall and Bartsch)
Epitonium densiclathratum Dall
Exilioidea kelseyi (Dall)
Fartulum bakeri Bartsch
Haminoea olgae Dall
Hipponix barbatus Sowerby
Homalopoma luridum (Dall)
Lacuna divaricata (Fabricius)
Lepidochitona alba (Linnaeus)
Lepidochitona sacharrina (Dall)
Leptochiton farallonis (Dall)
Leptochiton internexus (Carpenter)
Leptochiton luridus (Dall)
Leucosyrinx? persimilis leonis (Dall)
- Margarites helacinus* (Phipps)
Margarites lacunatus (Carpenter)
Margarites rhodia Dall
Mitra catalinae (Dall)
Mitrella permodesta (Dall)
Mopalia porifera Pilsbry
Ocenebra interfossa atropurpurea (Dall)
Ocenebra painei (Dall)
Ocenebra sclera (Dall)
Placiphorella stimpsoni (Gould)
Polinices canonicus (Dall)
Polinices nanus (Möller)
Propebela lotta (Dall)
Puncturella multistriata Dall
Rectiplanes? briseis (Dall)
Rectiplanes? hyperia (Dall)
Rectiplanes? litus (Dall)
Rectiplanes? rotula smithi (Dall)
Scissurella kelseyi Dall
Solariella varicosa (Mighels and Adams)
Tachyrhynchus lacteolus subplanatus (Carpenter)
Tachyrhynchus pratonus Dall
Taranis strongi (Arnold)
Trophon pacificus (Dall)
Trophon staphylina (Dall)
Trophon tenuisculptus Carpenter
Turritellopsis acicula stimpsoni Dall
Volutomitra alaskana Dall

DESCRIPTION OF NEW SPECIES AND SUBSPECIES

Cardita (Cyclocardia) ventricosa montereyensis Smith and Gordon,
new species

Text figures 2, 3.

Description of the holotype: Shell solid, rounded-triangular in outline, moderately compressed laterally; anterior margin rounded, with the dorsal and posterior margins gently curved and merging with no marked change in curvature; ventral margin gently curved also and oblique to the lower margin of the hinge-plate. Beaks anterior to the middle of the shell, depressed, not conspicuous, slightly prosogyrate, somewhat eroded. Valves thick, ornamented on the outside with about eighteen well-defined, low, rounded, radiating costae, with rather narrow interspaces, crossed by numerous concentric lirations that are stronger on the upper portion of the shell although inconspicuous in the intercostal spaces. Just anterior to the beaks is a small, depressed, slightly elongately-cordate, unornamented lunule. Posterior to the beaks is a long, narrow, escutcheon-like depression in which the ligament is situated. Periostracum greenish-brown and velvety in appearance, the pile set in radiating lines although appearing to be concentrically lamellose, especially near the ventral margin of the shell. Hinge-plate thick, its lower edge somewhat beveled; right valve with a solid triangular cardinal tooth immediately below the beak, its apex detached from the shell-margin and beveled above, set off by a furrow on each side forming a chevron into which the two cardinal teeth of the left valve fit; anterior cardinal tooth a small inconspicuous monticule in front of the anterior furrow; posterior cardinal a narrow elongate flange bordering the posterior furrow, separated by a shallow groove from the nymph on which the ligament is seated. Hinge-plate in the left valve with two cardinal teeth diverging in a chevron, the anterior small and subtriangular, the posterior a nearly straight alar flange terminating obliquely at the hinge-margin and separated by a moderately-wide groove from the nymph carrying the ligament; at the intersection of the hinge-margin and the anterior margin is a short, low, rounded ridge, which probably represents a rudimentary anterior lateral tooth; similarly, there is an irregularity at the intersection of the hinge-margin and the posterior margin. Muscle impressions in both valves deep-seated, the posterior pair roughly tear-shaped and the anterior pair somewhat reniform in shape, narrower at the upper ends; just above the anterior pair is another pair of small, impressed, ovate pedal-retractor impressions. The pallial line is simple, connecting the lower ends of the muscle impressions in each valve in a curve generally parallel to the ventral margin of the shell. This margin

is sculptured internally by quadrangular excavations that coincide with the ends of the external ribs. Dimensions: length, 25.8; width, 16.0; height, measured from the umbo in a line perpendicular to a line bisecting the muscle impressions, 23.0; oblique height, measured from the umbo to the posterior bulge, 25.2 mm.

Holotype: Calif. Acad. Sci., Paleo. Type Coll., No. 8518, dredged in 63 fathoms about 4.6 miles northwest of Point Pinos, in fine sand, sand pellets, and pebbles, Monterey Bay, California, August 22, 1932, by Mackenzie Gordon, Jr. The type lot consists of six specimens.

Paratypes: These include the five specimens collected with the type; four specimens and one valve from 52-55 fathoms, about 3.1 miles northwest of Point Pinos, in fine dark sand and pebbles, August 8, 1932, dredged by Mackenzie Gordon, Jr.; and five specimens dredged in 70 fathoms off Monterey by G. E. McGinitie. Paratype specimens have been placed in the California Academy of Sciences (Type Coll. Nos. 8519-8523, incl.), Stanford University, the U. S. National Museum, the Los Angeles Museum, and the private collections of S. S. Berry and Mr. and Mrs. E. P. Chace.

Range: Fort Bragg, Mendocino County, to Ventura, California, in 30-70 fathoms. A lot of over 100 specimens from the northern limit of the range (C.A.S. Locality No. 31141) shows intergradation with the typical *C. ventricosa*. The lot from Ventura (C.A.S. Locality No. 31700) consists of five small specimens that show no tendency to intergrade with the southern form of *C. ventricosa*.

Remarks: The cyclocardias of the west coast of North America are a difficult group with a comparatively limited range of variation. Unfortunately, there has been much taxonomic confusion regarding them.

Cardita ventricosa (Gould, 1850) was described from shells collected in Puget Sound, Washington, by members of the United States Exploring Expedition under Wilkes. There were two separate species in the type lot (U. S. National Museum No. 3373). The first, represented by several specimens, was a transversely ovate shell with a moderately weak hinge-arrangement. The second, represented by a single specimen, was a plump, elevated shell with high beaks and a strong hinge-arrangement.

According to Dall, Gould's diagnosis refers partly to both species, although this is not altogether clear from reading the original description. At any rate, Gould's dimensions of the specimen described, and his subsequent figure of it (Gould, 1852), can only be referred to the transversely ovate species and apparently also only to the largest specimen of the lot, which should be selected as the lectoholotype. Stearns (1890), however, mistakenly figured the single specimen belonging to the second species as Dr. Gould's type of *C. ventricosa*, at the same time assigning the species to the genus *Venericardia*, in which he was followed by Dall. Later, Dall (1902)

pointed out Stearns' error and designated Stearns' figured specimen as the type of a new species, which he called *Venericardia (Cyclocardia) stearnsii*.

Cardita stearnsii (Dall) appears to be a scarce but distinct species so far found only in the inland waters of British Columbia and northern Washington at depths of from 20 to 30 fathoms. The Gordon Collection in the California Academy contains two specimens from Puget Sound, which were in a lot of typical *ventricosa*, collected at the same time and location by T. S. Oldroyd. The species can be distinguished from *ventricosa* and its allies by its greater height with respect to length; its elevated, more strongly-prosogyrate beaks; its deeply-impressed lunule, and its strong elevated hinge, which, in the left valve, bears a prominently-developed anterior cardinal tooth behind the lunule, and a perceptibly curved posterior cardinal tooth. The periostracum of *C. stearnsii*, although radially pilose, lacks the velvety appearance of the periostracum of shells of the *ventricosa* group.

The writers recognize three forms of *C. ventricosa* (Gould) on the west coast of North America—the typical species and two subspecies. These have the following characters in common: the number of external ribs (18 to 20); the slightly prosogyrate beaks; the moderately-depressed lunule; the general form and structure of the hinge-plate; and the velvety-appearing periostracum. They differ principally in shell outline and in minor particulars of the hinge-plate.

In outline, the typical northern form of *C. ventricosa* is ovate; *C. ventricosa montereyensis*, found off the central California coast, is subtriangular and extended posteriorly; and the form found off the coast of southern California is subquadrangular and more ventricose. For this latter form Burch proposes the name *redondoensis* (Minutes, Conch. Club of Southern California, No. 39, pp. 14, 15, Sept., 1944, and No. 45, p. 11, March, 1945).

Cardita ventricosa montereyensis differs from the typical *C. ventricosa* also in the hinge-plate, in which the lower margin slopes anteriorly instead of being roughly parallel to the ventral margin of the shell; the posterior cardinal tooth in the left valve is somewhat stronger; the shell is more compressed with the beaks slightly less tumid, resulting in a smaller space behind the hinge-plate and a more heavily-butressed support behind the anterior cardinal tooth in the left valve; and the central cardinal tooth of the right valve is beveled above rather than acute. This last character, however, may be modified by one or two grooves in some individuals of either the species or the subspecies.

The difference in shape between *C. ventricosa montereyensis* and the southern form is due to the greater posterior attenuation and consequently more sharply-rounded posterior end of *montereyensis*, while *redondoensis* has a much more broadly-rounded posterior end. Also, *redondoensis* is more ventricose than either of the others; the central California form is the least ventricose. The range of *redondoensis*, based on several lots totalling about 30 specimens

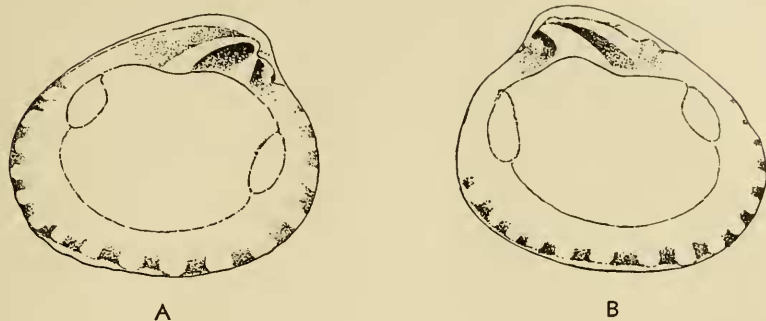


FIG. 2. *Cardita ventricosa montereyensis* Smith and Gordon, n.ssp. Holotype, C.A.S. Paleo. Type Coll. No. 8518. Length, 25.8; width, 16.0; height, 23.0; oblique height, 25.2 mm. A, interior view of left valve; B, same, right valve. (G. D. Hanna, del.)



FIG. 3. *Cardita ventricosa montereyensis* Smith and Gordon, n.ssp. Paratype, C.A.S. Paleo. Type Coll. No. 8519. Length, 17.0; width, 10.0; height, 15.7; oblique height, 16.9 mm. A, interior view of left valve; B, same, right valve. (G. D. Hanna, del.)

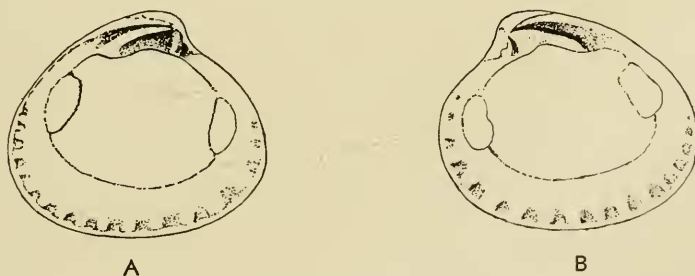


FIG. 4. *Cardita ventricosa* (Gould). Hypotype from Puget Sound, the type locality. C.A.S. Paleo. Type Coll. No. 8524. Length, 19.7; width, 11.9; height, 17.8; oblique height, 18.8 mm. A, interior view of left valve; B, same, right valve. (G. D. Hanna, del.)

in the collection of the California Academy, is from off Santa Cruz Island in 250 fathoms to Cortez Bank in 40 to 60 fathoms. Burch cites it from off Redondo Beach, in 100 fathoms.

From the fossil species of *Cardita*, *C. ventricosa* and its subspecies differ mainly in the number of radial ribs, as follows:

Species	No. of Ribs
<i>Cardita ventricosa</i> group	18-20
<i>Cardita occidentalis</i> Conrad	15
<i>Cardita monilicosta</i> Gabb	14-17
<i>Cardita californica</i> (Dall 1903, not Deshayes 1854)	14-16
<i>Cardita hilli</i> Willett	25-27

From the living species *C. longini* Baily (1945), they differ by having more ribs, *longini* having 13 to 15, and also in the fact that adult shells of *longini* average about half the size. The velvety-appearing epidermis further serves to distinguish the *ventricosa* group from all other living cyclocardias on the west coast of North America.

Dentalium berryi Smith and Gordon, new species

Plate 3, figures 1-4.

Description of the holotype: Shell relatively large for the genus on the Pacific Coast, fairly heavy, moderately curved throughout its length, attenuated toward the apex, the gradually diminishing diameter beginning at about the middle. Color of the upper half chalky white with a very pale brownish stain; of the lower half milk white, somewhat polished and shining. Upper half somewhat eroded. Sculpture consists of irregularly-spaced growth rings that mark the resting stages in the development of the shell; longitudinal striae absent. Aperture circular, thin-edged, not oblique. Exterior of apex also circular. Anal orifice a narrow slit, subrectangular in shape, with the long axis on the dorsal side of the shell. The slit appears to have been formed by the building up of layers of shell inside the orifice. Length 46.7 mm.; diameter of aperture, 3.7 mm.; diameter of apex, 1.4 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll. No. 8525, dredged in about 40 fathoms in fine muddy sand and shale fragments on **Humpback Reef, Monterey Bay, California**, by A. G. Smith, John Q. Burch, and Tom Burch, August, 1937. The type lot consists of three additional living adults, one dead imperfect adult, and two immature dead shells.

Paratypes: Specimens collected with the holotype and another lot consisting of one adult and one broken shell dredged in 20 fathoms in fine sand near the bell buoy off Cabrillo Point, Monterey Bay, by Mackenzie Gordon, Jr., August, 1932, are designated as paratypes. These have been placed in the California Academy of Sciences, the U. S. National Museum, Academy

of Natural Sciences of Philadelphia, and in the private collections of S. S. Berry, John Q. and Tom Burch, and A. G. Smith.

The three living adults are all remarkably like the holotype except for a difference in length and that two of them have a plain circular anal orifice, without notch or slit. The immature shells taper to a fine point and are more curved in the upper portion than the adult shells. One of these, a dead specimen, has the anal orifice slightly notched, with the notch prolonged on the dorsal side into a deep narrow slit.

Remarks: This species is unusual for the chalky upper portion of the adult shell, which lacks all traces of longitudinal striations. Evidently the curved tip, which is a feature of the immature stage, is eroded or broken off at a later stage, after which a slit and shallow notch may be formed by the adult shell in some instances. *D. berryi* differs from *D. semipolitum* Broderip and Sowerby by having a proportionally heavier shell, by the lack of longitudinal striations, by being more evenly curved throughout its length, and by having a chalky and more or less eroded upper portion. *D. semipolitum* appears to be a form found in shallower water, being dredged in 10-20 fathoms, although it has been taken with *D. berryi* in deeper water. From *D. pretiosum* Sowerby, *D. berryi* differs by being longer and more slender, and particularly in its chalky texture.

Retusa (Sulcularia) montereyensis Smith and Gordon, new species

Plate 3, figure 11.

Description of the holotype: Shell minute, white, translucent, with a pale straw-colored periostracum; subcylindrical, narrow anteriorly, slightly compressed at the center; base somewhat inflated. Apex deeply sunken; spire concealed; aperture narrowed posteriorly, rounded, extending well beyond the apex, while anteriorly it becomes wider, terminating in a rounded flare. Sculpture consisting of close-set, subequally spaced, rounded, somewhat sinuous, vertical, occasionally branching axial ribs, spaced about 24 to the millimeter; interspaces almost equal to the ribs in width, cut into squares by very fine, subequally spaced spiral lines, which do not pass over the ribs themselves. On the holotype this sculpture is hardly distinguishable on the base, but on other specimens it continues to the columella. Outer lip thin, somewhat sinuous and compressed at the center, smooth inside; pillar lip also thin; columella slightly thickened, almost straight. Body of shell has a slight glaze. Length, 2.8 mm.; maximum diameter, 1.1 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll. No. 8527, C.A.S. Loc. No. 23,820, dredged in 25 fathoms, in fine sand and shell fragments near the bell buoy off Cabrillo Point, Monterey, California, by G. D. Hanna and C. C. Church.

Paratypes: Specimens so designated are as follows: nine shells dredged

in 8-15 fathoms, in fine sand and broken shale off Del Monte, by Mackenzie Gordon, Jr., and G. E. McGinitie, August, 1932; a single specimen dredged in the same general locality in 15 fathoms, by G. D. Hanna, J. L. Nicholson, and A. G. Smith, July, 1930. These have been distributed to the U. S. National Museum, Stanford University, Los Angeles Museum, and the private collections of S. S. Berry, and A. G. Smith.

Remarks: At first we believed this little Monterey *Retusa* was referable to *R. xystrum* Dall. However, comparison of specimens with a hypotype of *xystrum* from San Pedro (No. 6414, Stanford Univ. Paleo. Type Coll.), which was rather poorly figured by Oldroyd (1927, vol. 2, pt. 1, pl. 2, fig. 10) has convinced us that the Monterey shell is a different species. The specimen of *R. xystrum* measures: length, 2.7 mm.; maximum diameter, 1.2 mm. It possesses faint threadlike spiral lirae between the axial ribs, a character overlooked by Dall in the original description (Proc. U.S.N.M., 1920, 56:297). The axial ribs are spaced 18 to the millimeter, there being approximately 50 on the last whorl. In *R. montereyensis* the ribs are spaced 24 to the millimeter, with almost 70 on a paratype of equivalent length. Also, the spiral striations of *montereyensis* are more closely spaced than on *xystrum*. There is practically no variation in the spacing of the axial ribs and the spiral lirae in all specimens of *montereyensis* we have examined, and in general it has a constantly more delicate sculpture than *xystrum*.

Metzgeria montereyana Smith and Gordon, new species

Plate 3, figure 6.

Description of the holotype: Shell moderately small, whitish, with a brown, minutely wrinkled, conspicuous periostracum. Nucleus with one and one-half whorls, small, depressed-turbinata, white, the tip smooth with weak transverse ribs appearing on the last half turn, the axis slightly oblique. Post-nuclear whorls four and one-quarter, evenly rounded, rather high and slightly obliquely inclined from the horizontal, separated by a moderately deep suture. Axial sculpture consists of 12 to 13 prominent, rounded, elevated axial ribs extending between the sutures and on the last whorl crossing the periphery to about the middle of the base, separated by slightly narrower interspaces. These are crossed by seven to eight narrow, rounded, elevated, spiral cords, which are strongest over the center of the whorl and weaker toward the sutures and separated by wider interspaces. Periphery well-rounded, marked by a continuation of the axial and spiral sculpture. Base and canal have 16 spiral cords that become successively closer spaced toward the end of the canal. Aperture less than half as long as the shell; outer lip thin (partly broken off in the holotype), smooth and whitish within; pillar whitish, somewhat recurved anteriorly, ornamented behind the angle by three distinct, subequally spaced, oblique plaits, the posterior one weaker than

the other two; canal slightly oblique, open, and moderately wide. Length of shell, 12.4 mm.; of aperture and canal, 5.7 mm.; maximum diameter, 4.8 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll., No. 8530; a single dead specimen dredged in 15 fathoms, in fine sand and broken shale off **Del Monte, Monterey Bay, California**, by Mackenzie Gordon, Jr., August, 1932.

Remarks: This species is the second *Metzgeria* to be described from the California coast. It differs from *M. californica* Dall in having three to four less axial ribs on the whorls, in lacking the inflated whorls, and in having a shorter, more oblique canal.

Balcis delmontensis Smith and Gordon, new species

Plate 3, figure 5.

Description of the holotype: Shell small, broadly conic, vitreous, yellowish to milk-white. Axis of whorls appears straight at first glance but actually curves slightly to the right. Nuclear whorls two and one-half, smooth, and well-rounded, the first helicoid and loosely coiled. Post-nuclear whorls six, gently rounded except the last, which is subangulated about one-quarter of the distance below the suture. Whorls polished, with a few weak, irregularly situated varices. Periphery of the last whorl inflated and sharply rounded. Base short, gently rounded, smooth. Aperture moderately large, ovate, the posterior angle acute; outer lip thin at the edge, somewhat produced; inner lip thick, strongly curved, reflected over the base and appressed to it posteriorly; parietal wall glazed with a thin callus. Length, 4.5 mm.; maximum diameter, 2.2 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll., No. 8531; dredged in 10 fathoms, in fine sand and shale fragments off **Del Monte, Monterey Bay, California**, by A. G. Smith and C. S. Fackenthall, August, 1913.

Paratypes: Specimens so designated consist of the following lots: Three shells dredged in 10 fathoms, in granite sand and broken shells off Cabrillo Point, by A. G. Smith, August, 1913 (AGS No. 5087); two specimens dredged in 10 fathoms off Del Monte, by Mackenzie Gordon, Jr., August, 1932; seven immature shells (C.A.S. Paleo. Type Coll. Nos. 8532-8538, incl.) dredged in 25 fathoms near the bell buoy off Cabrillo Point; a single immature specimen dredged in 8-10 fathoms in sand off Del Monte (AGS No. 5089); and two specimens from a seaweed holdfast off Del Monte (AGS No. 8266). Distribution of paratypes has been made, in addition to those in the Academy's collection to the U. S. National Museum, Stanford University, Los Angeles Museum, and the private collections of S. S. Berry, John Q. and Tom Burch, and A. G. Smith.

Remarks: This species is nearest to *B. tacomaensis* (Bartsch), but is more broadly conic, has a more inflated base, and lacks the conspicuously false suture of the latter species. It may be readily distinguished from other melanellas found in Monterey Bay by its inflated base and its straight columella.

Turbonilla (Turbonilla) fackenthallae Smith and Gordon, new species

Plate 3, figures 7, 8.

Description of the holotype: Shell rather large for the subgenus, robust, broadly conic, milk-white. Nuclear whorls helicoid, two and one-half, at right angles to and about one-third immersed in the first post-nuclear turn. Post-nuclear whorls 10, well rounded, very narrowly tabulate at the summits, especially on some of the whorls where the axial ribs are posteriorly truncated. Sutures prominent. The sculpture consists of broad, rounded, prominent, moderately protractive axial ribs, of which there are 10 on the first, 12 on the second to fifth, 14 on the sixth, 12 on the seventh, 10 on the eighth, 12 on the ninth, and 16 on the last whorl where they are slightly less prominent than on the others. The ribs are separated by well marked, rounded interspaces, from one-half to five-sixths the width of the ribs, and which just start to die out as they reach the suture. Axial sculpture crossed by numerous, faintly-incised spiral lines, discernible only under fairly high magnification. Periphery well rounded; base rather elongate, gently rounded and sculptured by lines of growth and the fine spiral lines. Aperture subquadrate; posterior angle acute; outer lip thin, showing the axial sculpture within. Columella thin, gently curved, inclined in the same plane as the axial ribs. Length, 7.7 mm.; maximum diameter, 1.9 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll., No. 8539, Locality No. 24,147, dredged in 20-30 fathoms, in sand, **between the bell buoy off Cabrillo Point and the shale bed off Del Monte, California**, by G. D. Hanna, J. L. Nicholson, and A. G. Smith, June, 1930.

Paratypes: Two specimens were collected with the holotype, one of which has been placed in the U. S. National Museum. This latter shell has 10 whorls, the nuclear whorls being lost. It differs from the holotype in the following particulars: Rib count the same except for 11 on the sixth, 11 on the eighth, and 15 on the last whorl; the interspaces do not quite reach the sutures, leaving a smooth narrow band just below them; on the early whorls this character affects the whorl below so that the narrow tabulation at the summits of the whorls is almost lacking, except when some of the ribs tend to be truncated posteriorly. The second paratype is in the collection at Stanford University.

Remarks: This species can be identified easily by the robust shape of the shell; the broad, prominent, moderately protractive axial ribs; and its rel-

atively large size. Named in memory of the late Mrs. Charles S. Fackenthal, who collected shells for many years in the Monterey region.

Turbonilla (Pyrgolampros) stillmani Smith and Gordon, new species

Plate 3, figure 9.

Description of the holotype: Shell small, narrowly conic, flesh-colored, with a narrow indistinct brown band at the periphery, and another less distinct pale brown band just below the suture. Nuclear whorls one and three-quarters, depressed, helicoid, with the axis almost at right angles to that of the succeeding turns, in the first of which they are approximately one-fourth immersed. The five post-nuclear whorls appear to be gently rounded but on close inspection they are actually almost flattened laterally and strongly rounded above. Sutures deeply channeled. Axial sculpture consists of broadly rounded, elevated, straight, very slightly retractive ribs, of which there are 20 on the second, 18 on the third, 22 on the fourth, and 26 on the fifth whorl. These are separated by narrower, shallowly-channeled interspaces. On the last whorl the ribs are somewhat enfeebled and split. Axial sculpture crossed by exceedingly fine, lightly-incised spiral striae, hardly perceptible except under fairly high magnification. Periphery of the last whorl rounded, moderately inflated. Base rounded, marked by feeble continuations of the axial ribs and the spiral striae. Aperture suboval; posterior angle acute; outer lip thin; columella slender, slightly twisted; inner lip reflected anteriorly and appressed to the base. Length, 3.5 mm.; maximum diameter, 1.1 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll. No. 8540, dredged in 10 fathoms, in sand and shale fragments, **one-half mile off Del Monte Pier, Monterey Bay, California**, by Mackenzie Gordon, Jr. and G. E. McGinitie, August, 1932. Two other specimens were collected.

Paratypes: Specimens so designated include the two collected with the holotype; a single specimen from about the same locality dredged by A. G. Smith and C. S. Fackenthal, July, 1913; and a specimen from Monterey collected by George Willett. They are placed in the collections at Stanford University and the U. S. National Museum, and the private collections of George Willett and S. S. Berry.

Remarks: This species is related most closely to *T. pesa* Dall and Bartsch but is distinguished from it in having a more elongate base, better defined axial ribs, and broader early post-nuclear whorls. It resembles none of the southern California species closely. Tentatively referred to this species also is a single specimen dredged in 25 fathoms off Coronado Beach, California, by Mackenzie Gordon, Jr., September, 1933. Named in honor of Dr. S. Stillman Berry, of Redlands, California, whose work on the molluscan fauna of Monterey Bay is thus signalized. The name was also chosen in partial compensation for the necessity of placing *T. berryi* Dall and Bartsch in the synonymy of *T. chocolata* (Carpenter).

Turbonilla (Pyrgolampros) willetti Smith and Gordon, new species

Plate 3, figure 10.

Description of the holotype: Shell small, rather broadly conic. Color light brown, with a narrow dark brown band just above the periphery showing on all the whorls, a wider but fainter brown band just below the periphery, and a small but still paler colored area at the columella. Nuclear whorls helicoid, two and one-half, at right angles to and about one-fourth immersed in the first post-nuclear turn. Post-nuclear whorls eight, very gently rounded but more so at the summits, with narrow but distinct tabulations. Sutures well incised and prominent. Axial sculpture consists of broad, rounded, generally vertical ribs, of which there are 12 on the second, 14 on the third, 16 on the fourth, fifth, and sixth, 18 on the seventh, and 20 on the last whorl. On some of the whorls the ribs are slightly protractive. They are separated by narrow, moderately deep interspaces that are usually about one-half the width of the ribs. On the last whorl the ribs are not so strongly developed as on those preceding it. Ribs and interspaces crossed by numerous fine, wavy, spiral lines. Aperture pyriform; posterior angle acute; outer lip thick (slightly broken away), rounding with a slight flare into the straight, fairly thick, revolute, oblique columella. Length, 5.8 mm.; maximum diameter, 1.6 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll., No. 8541, dredged in 10 fathoms, in sand and shale fragments, **one-half mile off Del Monte Pier, Monterey Bay, California**, by Mackenzie Gordon, Jr., and G. E. McGinitie, August, 1932.

Remarks: This species is known so far only from the holotype, which is sufficiently different from others described under the subgenus *Pyrgolampros* that we have no hesitancy in naming it as new. The narrow tabulation of the whorls is a particular feature. In this it is probably closest to *T. strongi* Willett although the latter is a much less robust shell. The holotype of *willetti* has been compared with paratypes of *strongi* in the Willett collection. Named in honor of the late George Willett, former Curator of Conchology and Ornithology, Los Angeles Museum.

Turbonilla (Bartschella) bartschi Smith and Gordon, new species

Plate 3, figure 13.

Description of the holotype: Shell small, elongate-conic, cream-white. Nuclear whorls two and one-half, helicoid, with the axis set obliquely to that of the next succeeding turn in which it is about one-third immersed. Post-nuclear whorls six, well rounded, strongly constricted at the sutures. Sculpture consists of strong, narrow, sharp, subequally spaced, raised, sinuous, axial ribs, of which there are 17 on the first, 21 on the second and third, 25 on the fourth, and 30 on the last whorl. The ribs are protractive over most

of the whorl but at the summit and at the suture they are somewhat retractive. The whorls are also sculptured by nine spiral cords, equal in strength to the ribs and rendering them somewhat nodulous at the points where they cross. The intercostal spaces are twice the width of the ribs and are in the form of deep squarish pits. Periphery of the last whorl gently rounded. Base marked by continuations of the axial ribs, which reach almost to the umbilical area, and sculptured by eight spiral cords that are progressively more closely spaced and become progressively weaker as the umbilicus is approached. Aperture large, pyriform; posterior angle acute; columella slender, curved; umbilical chink present. Length, 2.0 mm; maximum diameter, 0.7 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll., No. 8542, Locality No. 23,820, dredged in 25 fathoms near the bell buoy off **Cabrillo Point, Monterey Bay, California**, by G. D. Hanna and C. C. Church.

Remarks: This species is known so far only from the holotype. It is unique in the further sense of being the only *Bartschella* from the West Coast of North America with such sharp sinuous ribs. Named in honor of Dr. Paul Bartsch whose valuable work with Dr. W. H. Dall on the western American Pyramidellidae now serves as a starting point for all future studies of this group.

Odostomia (Salassiella) heathi Smith and Gordon, new species

Plate 3, figure 14.

Description of the holotype: Shell small, conic, milk-white, with a narrow brownish band just below the center of the whorls. Nuclear whorls two and one-half, with the axis almost at right angles to the succeeding turns, in the first of which it is approximately one-third immersed. Post-nuclear whorls four and one-half, moderately rounded and shouldered at the summits, marked by slightly flexuous, lamellar, axial ribs, which are but feebly present on the first half turn. There are 28 of these ribs on the second and third, 25 on the fourth, and 24 on the last whorl. The intercostal spaces are about one-third as wide as the ribs and are moderately well impressed. Varices are sparse and irregularly placed, being best developed on the earlier whorls, and extend strongly to the sutures. Periphery of whorls subangulate; sutures well impressed. Base rounded, marked by feeble continuations of the axial ribs almost to the umbilical area, which is relatively smooth. Aperture subpyriform; posterior angle acute; outer lip moderately thin, smooth within; columella almost straight, slender, provided with a weak fold at its insertion. Length, 2.8 mm.; maximum diameter, 1.0 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll., No. 8543, dredged in 15 fathoms near the bell buoy off **Cabrillo Point, Monterey, California**, by Mackenzie Gordon, Jr.

Remarks: Known only from the holotype. This is the first species of the

subgenus *Salassiella* found north of San Pedro, California. It differs from other West American representatives of the subgenus by the greater number of axial ribs on the earlier whorls. Named for Dr. Harold Heath, well-known biologist (now emeritus) of the Hopkins Marine Biological Laboratory at Pacific Grove, California.

***Odostomia (Menestho) churchi* Smith and Gordon, new species**

Plate 3, figure 12.

Description of the holotype: Shell small, subcylindrical, translucent, white. Nuclear whorls smooth, two and one-half, prominent, obliquely immersed in the next succeeding turn. Post-nuclear whorls nearly four, moderately rounded, with a sloping shoulder that gives the shell a tabulated aspect. There is a slight suggestion of a constriction at the periphery of the whorls. Sculpture consists of about 25 low, flattened, subequal, spiral cords, which are separated, in turn, by fine, wavy, well-impressed, spiral grooves. In addition to these there are numerous and very fine axial and spiral striae that form a network over the entire shell, visible only under high magnification. Periphery and base well rounded and, like the spire, sculptured by spiral cords, of which there are about 15, and the reticulate striae. Aperture pyriform, entire; outer lip thin, the sculpture showing through. Columella strong, greatly reflected; posterior angle obtuse. Length, 1.8 mm.; maximum diameter, 0.5 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll., No. 8544, dredged in 25 fathoms near the bell buoy off **Cabrillo Point, Monterey Bay, California**, by G. D. Hanna and C. C. Church.

Remarks: This species is known so far only from the holotype. It suggests *O. (Ivara) turricula* Dall and Bartsch, but is much more elongate and lacks the feeble axial ribs of the latter species. It is also rather like *O. (Menestho) pharcida* Dall and Bartsch, but is more shouldered and has more spiral lirae. Named for Mr. Clifford C. Church, paleontologist with the Tidewater-Associated Oil Company, one of the collectors of the holotype.

***Rissoella hertleini* Smith and Gordon, new species**

Plate 3, figure 15.

Description of the holotype: Shell small, subglobose, translucent, light yellowish-brown. Nuclear whorls one and one-quarter, well rounded, smooth. Post-nuclear whorls three, rounded, but with a slight posterior flattening, smooth except for minute irregularities caused by normal lines of growth and by stopping points in the development of the shell. Sutures moderately constricted. Periphery strongly rounded, marked like the spire, and with a small umbilicus. Umbilical area bounded above by a moderate angulation. Aperture

semi-lunar, the posterior angle almost a right angle; outer lip thin, well rounded, meeting the inner lip at an obtuse angle; inner lip thin above, strongly reflected below, prominently channeled behind, and appressed to the base at the extreme lower end; peritreme completed by a fairly heavy callus on the parietal wall. Operculum corneous, thin, imbricate, with a submarginal clawlike process on the posterior side. Length, 2.2 mm.; maximum diameter, 1.5 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll., No. 8545, dredged in 10 fathoms, in sand, off **Cabrillo Point, Monterey Bay, California**, by A. G. Smith, July, 1913. Six additional specimens, similar in all respects to the holotype, were collected with it.

Paratypes: Specimens so designated are the six just mentioned. They have been placed in the U. S. National Museum, the Los Angeles Museum, the San Diego Society of Natural History, Stanford University, and the private collections of S. S. Berry, and A. G. Smith (No. 2010).

Remarks: This species is closely related to those already described from the west coast of Lower California. The operculum has the same characters as those of the genotype (See Tryon, *Man. Conch.*, vol. 9, pl. 54, figs. 96, 97). It may be identified easily by its subglobose shape, channeled umbilical area, and lack of distinctive sculpture. Named for Dr. Leo G. Hertlein, Assistant Curator of Paleontology, California Academy of Sciences, San Francisco.

***Alaba serrana* Smith and Gordon, new species**

Plate 4, figures 1, 2.

Description of the holotype: Shell small, elongate-conic, light cream-white. Whorls 10 (the last imperfect), the early ones rounded, the later ones with a sloping shoulder that forms a slight angulation about one-quarter of the distance below the suture. On the last entire whorl three more faint angulations or subobsolete carinae are spaced equally between the shoulder edge and the periphery. No incised lines are present. Axial sculpture consists of fine, sinuous, protractively slanting lines of growth. Varicial thickenings make their appearance on the second whorl, where they are feebly developed, although they increase in strength on the succeeding turns. Periphery subangulate; base gently rounded. Aperture broken away, suboval; outer lip thin; posterior angle obtuse. Columella curved, the parietal wall covered by a thin callus. Length, 5.2 mm.; maximum diameter, 1.8 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll., No. 8546. Locality No. 24,830, dredged in 25 fathoms, **Carmel Bay, California**, with a tow net that accidentally scraped bottom, by W. L. Scofield of the California Division of Fish and Game, who turned the material so obtained over to Dr. Harold Heath.

Paratype: Calif. Acad. Sci. Paleo. Type Coll. No. 8547; a single specimen dredged with the holotype. It is immature, shining, translucent, and more slender than the holotype, with sculpture consisting of fine, closely-spaced punctations on the earlier whorls. It has eight whorls and measures: length, 3.4 mm.; maximum diameter, 1.2 mm.

Remarks: This species is most nearly related to *A. catalinensis* Bartsch, from which it differs by its subangulate spiral sculpture. It represents a considerable extension northward of the range of the genus. Named for Padre Junipero Serra, who founded the mission at Carmel.

Rissoina hannai Smith and Gordon, new species

Plate 4, figure 4.

Description of the holotype: Shell small, elongate-conic, translucent, milk-white. Nuclear whorls two, well rounded, smooth. Post-nuclear whorls five, moderately rounded, appressed at the summits, giving the appearance of having a double suture. Under low magnification the whorls appear to be devoid of sculpture, but under higher power the sculpture is seen to consist of numerous, extremely fine, closely spaced axial striae or lines of growth. Occasionally a small, obsolete axial rib begins to develop near the suture but dies out immediately and is overridden by the axial striae. Under still higher magnification a number of tiny, irregularly-spaced punctations make their appearance. Periphery and base gently rounded, marked like the spire. Aperture large, effuse, slightly channeled at the posterior angle; outer lip moderately thick and effuse; inner lip also fairly thick, curved, and appressed to the base; parietal wall covered by a callus that renders the peritreme complete. Length, 2.7 mm.; maximum diameter, 1.3 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll., No. 8548, Locality No. 24,830, dredged in 25 fathoms in **Carmel Bay, California**, with a tow net by W. L. Scofield of the California Division of Fish and Game and sent to the Academy by Dr. Harold Heath. In addition to the holotype, 27 other specimens were taken.

Paratypes: Specimens so designated have been placed in the California Academy of Sciences (Type Nos. 8549-8552, inc.), the U. S. National Museum, the Philadelphia Academy of Sciences, Stanford University, the San Diego Society of Natural History, the Los Angeles Museum, and in the private collections of S. S. Berry, A. G. Smith, E. P. and E. M. Chace, and Tom and John Q. Burch.

Remarks: This species is nearest to *R. cerrosensis* Bartsch, but its shape is elongate-conic while the latter species is decidedly ovate. From all other described West American species it differs in having no apparent sculpture under low magnification. Named for Dr. G. Dallas Hanna of the California Academy of Sciences.

Rissoina keenae Smith and Gordon, new species

Plate 4, figure 3.

Description of the holotype: Shell small, elongate-conic, subdiaphanous, milk-white. Nuclear whorls two, smooth and shining. Post-nuclear whorls four, strongly rounded, very narrowly and feebly beveled at the sutures, marked by almost vertical, generally straight, closely-spaced, axial threads, which vary somewhat in strength, and which are equally spaced except occasionally when two or more coalesce or where there is a variation in strength. The axial threads are weakly defined on the first post-nuclear whorl, become stronger on the second, and reach maximum development on the last two, on which there are 56 to 58 of them. Intercostal spaces are generally less than half the width of the threads. There is occasional splitting of the threads also, with the result that some of them are not continuous across the entire whorl. Sutures strongly impressed. Base slightly concave posteriorly, marked by continuations of the axial threads, which extend without diminution in strength to the umbilical area. Aperture large, somewhat oblique, suboval. Outer lip reinforced by a thick varix immediately behind the edge, the posterior portion being slightly reflected. Inner lip thin, gently curved, reflected over and appressed to the base, making the peritreme complete. Length, 2.8 mm.; maximum diameter, 1.1 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll., No. 8553, dredged in 5-15 fathoms off Point Pinos, Monterey Bay, California, in coarse granite sand and broken shells, by A. G. Smith and Mackenzie Gordon, Jr., September, 1932. Two additional specimens were collected with the holotype.

Paratypes: Specimens so designated are the two just mentioned, and two others dredged in 15 fathoms, in fine sand near the bell buoy off Cabrillo Point by Mackenzie Gordon, Jr. They have been placed in the U. S. National Museum, Stanford University, and the private collections of S. S. Berry and A. G. Smith.

Remarks: This species differs from others described from the Pacific Coast by having a larger number of axial threads of relatively equal strength that cross the post-nuclear whorls. It has the well-rounded whorls of *R. bakeri* Bartsch, but lacks the strong axial ribs of that species. From *R. newcombei* Dall it differs by having more rounded whorls, with more and closer-spaced axial threads. All of the specimens collected show no marked deviation in shape or sculpture. Named for Dr. A. Myra Keen, Curator of the Paleontological Collections, Stanford University.

Calyptreae burchi Smith and Gordon, new species

Plate 4, figures 11-13.

Description of the holotype: Shell of medium size, low, broadly conic, with a circular aperture and slightly concave sides. Exterior whitish, chalky,

and covered with a thin yellowish-brown epidermis. Nuclear whorls a little over one and one-half, smooth, yellowish-brown; the first oblique, rounded, and set off by a prominent suture, giving the shell a mammillate aspect. The post-nuclear portion of the shell expands rapidly and is marked externally only by circular lines of growth. Interiorly the shell carries the spiral septum usual in the genus, which is white, markedly sinuate at the edge, and which shows closely-spaced, sinuate lines of growth that are alternately an opaque milk-white and translucent. Toward the columella the septum margin becomes recurved and finally folded back on the columella itself, to which it is appressed and fused. Remainder of the interior smooth and polished, but under medium magnification both this and the septum have finely-granulated microscopic sculpture. Color of the interior light yellowish-brown marked by many flecks and flammulations of darker brown. Margin thin. Maximum diameter, 16.3 mm.; height, 6.4 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll., No. 8554, Locality No. 24,147, dredged in 20-30 fathoms **between the bell buoy off Cabrillo Point and the shale bed off Del Monte, Monterey Bay, California**, by G. D. Hanna, J. L. Nicholson, and A. G. Smith, July, 1930. The type lot consists of the holotype and two immature shells.

Paratypes: Specimens so designated include the two young shells just mentioned and the following additional lots: four adult and four immature specimens in the A. G. Smith (No. 5748) and the J. Q. Burch collections, dredged in 35-40 fathoms, on shale, at Humpback Reef, off Monterey; an imperfect adult and two young shells dredged in 15 fathoms off Del Monte on the shale bed, by A. G. Smith (No. 3644); one young shell dredged in the same locality by Mackenzie Gordon, Jr.; and two dead specimens from 25 fathoms, in shelly sand, off Del Monte in the Berry collection (SSB No. 1677).

Remarks: Two additional small lots that appear to be this species are in the California Academy's Collection. They are from Carmel. Differs from *C. fastigiata* Gould in its smaller size and in the brown markings, which also show on the outside of the shell on some of the paratypes. Differs from *C. contorta* (Carpenter) by having a colored nuclear apex instead of a white one, by its larger size, and also in its brown markings. All shells of these two other species in the lots we have seen from the West Coast north of San Pedro are white and otherwise uncolored. Named for John Q. and Tom Burch of Redondo Beach, California.

Margarites keepi Smith and Gordon, new species

Plate 4, figures 5-7.

Description of the holotype: Shell small, broadly conic, whitish with occasional dark flammulations. Nuclear whorls one and one-half, somewhat

oblique, smooth. Post-nuclear whorls three, sloping, tabulate, marked by three spiral keels. The first of these keels consists of a thin, raised, spiral thread adjacent to the suture; the second and third are prominent, of equal strength, and divide the whorl into three equal parts. Periphery marked by a strong cord of about the same prominence as the second and third keels. The keels are crossed by about 24 raised, retractive, axial riblets of slightly lesser strength than the keels, forming well-developed tubercles at the points of crossing. The axial riblets die out at the periphery, beyond which the base slopes gently to the umbilicus. Base sculptured with seven spiral cords that decrease successively in strength toward the umbilical region, the outer four being well developed. The basal cords are crossed by very fine, closely-spaced, slightly retractive, axial lines. Aperture suboval; outer lip thin, crenulated by the spiral keels; columella moderately thin, curved, and reflected so that it partially closes the umbilicus; posterior angle obtuse; parietal wall covered by a thin wash of callus. Height, 2.0 mm.; maximum diameter, 2.1 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll., No. 8557, Locality No. 23,820, dredged in 25 fathoms, in sand, near the bell buoy off **Cabrillo Point, Monterey Bay, California**, by G. D. Hanna and C. C. Church. Four additional specimens were taken with the holotype.

Paratypes: Specimens so designated have been placed in the California Academy's collection (Nos. 8558, 8559), the U. S. National Museum, and the private collection of A. G. Smith. They are part of the type lot.

Remarks: This species is unique among the *Margarites* described from the West Coast of North America, there being no other with such strong axial ribbing and tuberculation. Named in honor of Professor Josiah Keep, formerly of Mills College, who did so much to advance the knowledge of the shells of the West Coast.

***Skenea carmelensis* Smith and Gordon, new species**

Plate 4, figures 8-10.

Description of the holotype: Shell small, depressed, turbate, white. Nuclear whorls one and one-half, helicoid, smooth. Post-nuclear whorls one and one-half, well rounded, sloping posteriorly, marked by a number of narrow, slightly raised, rounded, spiral cords, separated by V-shaped or U-shaped grooves, and crossed by irregularly-spaced lines of growth. Periphery of the last whorl strongly rounded. The base slopes gently into the umbilical angle and is sculptured by many spiral cords of lesser dimension but more closely spaced than those on the spire. The spiral cords continue weakly but a short distance beyond the umbilical angle into the rather narrow umbilicus, which is marked mainly by continuations of the lines of growth. Aperture nearly circular; posterior angle obtuse; outer lip thin, minutely

crenulated by the spiral cords; inner lip thin, curved, appressed to the base above, slightly reflected over the umbilicus, and also reflected and grooved below; parietal wall covered by a thin callus, making the peritreme complete. Height, 1.3 mm.; maximum diameter, 1.7 mm.

Holotype: Calif. Acad. Sci. Paleo. Type Coll., No. 8560, Locality No. 24,830, dredged in 25 fathoms, in sand, in **Carmel Bay, California**, with a tow net by W. L. Scofield of the California Division of Fish and Game and forwarded to Dr. Harold Heath, who turned the material over to the California Academy. Three other specimens were dredged with the holotype.

Paratypes: Specimens so designated are the three just mentioned. They have been placed in the California Academy of Sciences (Nos. 8561, 8562), and the private collection of A. G. Smith.

Remarks: There remains a certain amount of doubt in assigning this species to Vitrinellidae because of the relatively small size of the nuclear whorls and the narrowness of the umbilicus. However, the thinness of the shell and the configuration of the columella do not appear to warrant placing it in Turbinidae or in Trochidae. We have seen nothing else like it from the Monterey region or elsewhere.

SYNONYMIC NOTES

- Acmaea cassis* Eschscholtz, *A. cassis pelta* Eschscholtz, *A. cassis monticola* Dall, *A. cassis nacelloides* Dall, and *A. cassis olympica* Dall, see *A. pelta* Eschscholtz—Grant, 1938.
- Acmaea permabilis* Dall, see *A. ochracea* (Dall)—Grant, 1938.
- Acmaea scutum patina* Eschscholtz, *A. scutum pintadina* (Gould), *A. scutum parallela* Dall, and *A. emydia* Dall, see *A. scutum* Eschscholtz—Grant, 1938.
- Acmaea spectrum* Reeve, see *A. scabra* (Gould)—Dall, *Nautilus*, vol. 28, (2), p. 14.
- Alectrion*, Montfort, 1910, see *Nassarius* Duméril, 1805—Grant and Gale, 1931, pp. 670, 672.
- Alvania* Risso, 1826—For discussion of the classification of the northwest American species under this genus, see Gordon, *Nautilus*, vol. 53, (1), pp. 29-33.
- Antiplanes* Dall, 1902 (in part), see *Rectiplanes* Bartsch, 1944, created to include certain dextral turrids formerly included in *Antiplanes*. Type: *Rectiplanes santarosana* (Dall)—Bartsch, 1944b, p. 59.
- Antiplanes* Dall, 1902 (in part), see *Rhodoptoma* Bartsch, 1944, for *A. amycus* Dall—Bartsch, 1944b, p. 59.
- Ara perronides* (Carpenter), see *A. bailyi* (Bartsch)—Reinhart, 1943, pp. 35, 82.
- Astraea inaequalis montereyensis* Oldroyd, see *A. inaequalis* (Martyn). We are of the opinion that this subspecies has doubtful taxonomic value.
- Basiliochiton* Berry, 1918—For use as a genus to include *Lepidochitona flectens* (Carpenter), *L. flectens heathii* Pilsbry (= *Mopalia heathii* Pilsbry), and *Basiliochiton lobium* Berry, see Berry, 1925.
- Botula diegensis* Dall, see *Volsella diegensis* (Dall)—Grant and Gale, 1931, p. 253.
- Cardita* Bruguière, 1792 (in part), see *Glans* Megerle von Mühlfeldt, 1811—Grant and Gale, 1931, p. 276.
- Cardita subquadrata* (Carpenter), see *Glans carpenteri* Lamy—Lamy, 1922, p. 264.
- Cardiidae*—For latest arrangement, see Keen, 1937b.
- Cardium corbis* (Martyn), see *C. nuttallii* Conrad—Keen, 1936.
- Cavolina occidentalis* Dall, see *C. tricuspidata* (Rivers)—Grant and Gale, 1931, p. 441.
- Chemnitzia gracillima* Gabb, see *Turbonilla gabbiana* (Cooper)—Cooper, 1870a, p. 66.
- Cerithiopsis sassetta* Dall, see *Bittium serra* Bartsch—This paper, p. 196.
- Chaetopleura* Shuttleworth, 1853, see *Dendrochiton* Berry, 1911, for use of this latter genus to include *C. thamnopora* Berry, *C. gothica* Carpenter, and *Dendrochiton semiliratus* Berry—Berry, 1911b.
- Chironia* Deshayes, 1839—For use of this genus name in place of *Kellia* Turton, 1822, see Grant and Gale, 1931, p. 299.
- Chrysodomus* Swainson, 1840, see *Neptunea* Bolten, 1798—Grant and Gale, 1931, pp. 652-653.
- Clathrodrillia* Dall, 1918, see *Ophioderma* Bartsch, 1944, for *C. halcyonis* (Dall) and *C. incisa ophioderma* (Dall)—Bartsch, 1944b, pp. 61-62.
- Columbella* Lamarck, 1799 (as used in Dall, Bull. No. 112), see *Mitrella* Risso, 1826—Grant and Gale, 1931, pp. 679, 683, 689-698.
- Corbula* Bruguière, 1798, see *Aloidis* Megerle von Mühlfeldt, 1811—Winckworth, 1930, p. 15; Keen, 1937a, p. 18; Gardner, *Nautilus*, vol. 40, (2), p. 43.
- Crepidula* Lamarck, 1799, see *Crepipatella* Lesson, 1830, for *C. lingulata* Gould and *C. orbiculata* Dall—Woodring, *Minutes, Conch. Club of So. Calif.*, No. 56, p. 17, Jan. 1945.
- Cryptoconus* von Koenen, 1867, see *Megasurcula* Casey, 1904—Grant and Gale, 1931, pp. 495, 501; Keen, 1937a, p. 40.
- Cryptogemma* Dall, 1917, see *Carinoturris* Bartsch, 1944, for *C. adrastia* Dall—Grant and Gale, 1931, p. 571; Bartsch, 1944b, p. 60.

- Cumingia lamellosa* Sowerby, see *C. californica* Conrad—Keen, 1937a, p. 20.
- Cuspidaria* Nardo, 1840, see *Cardiomya* A. Adams, 1864—Stewart, 1930, p. 308.
- Cuspidaria nana* Oldroyd, see *Sphenia nana* (Oldroyd)—Based on the type in the Stanford collection (Keen, in correspondence).
- Cyanoplax hartwegii muttallii* (Carpenter), see *C. hartwegii* (Carpenter)—Berry, 1933, p. 435.
- Cyclostremella californica* Bartsch, see *Skenea californica* (Bartsch)—Iredale, Proc. Mal. Soc. London, 1915, vol. 11, p. 292.
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EXPLANATION OF PLATES

PLATE 3

Fig. 1. *Dentalium berryi* Smith and Gordon. Holotype No. 8525 (C.A.S.), about 40 fathoms, Monterey Bay, California. Length, 46.7 mm.; diameter of aperture, 3.7 mm.; diameter of apex, 1.4 mm.; p. 216.

Fig. 2. Same. Paratype No. 8526 (C.A.S.).

Fig. 3. Same. Enlarged view of notched apex of the holotype shown in Fig. 1.

Fig. 4. Same. Enlarged view of plain circular apex of the paratype shown in Fig. 2.

Fig. 5. *Balcis delmontensis* Smith and Gordon. Holotype No. 8531 (C.A.S.), 10 fathoms off Del Monte, California. Length, 4.5 mm.; maximum diameter, 2.2 mm.; p. 219.

Fig. 6. *Metzgeria montereyana* Smith and Gordon. Holotype No. 8530 (C.A.S.), 15 fathoms off Del Monte, California. Length, 12.4 mm.; maximum diameter, 4.8 mm.; p. 218.

Fig. 7. *Turbonilla (Turbonilla) fackenthallae* Smith and Gordon. Holotype No. 8539 (C.A.S.), 20-30 fathoms, Monterey Bay, California. Length, 7.7 mm.; maximum diameter, 1.9 mm.; p. 220.

Fig. 8. Same. Paratype (Stanford Univ. Paleo. Type Coll.).

Fig. 9. *Turbonilla (Pyrgolampros) stillmani* Smith and Gordon. Holotype No. 8540 (C.A.S.), 10 fathoms off Del Monte, California. Length, 3.5 mm.; maximum diameter, 1.1 mm.; p. 221.

Fig. 10. *Turbonilla (Pyrgolampros) willetti* Smith and Gordon. Holotype No. 8541 (C.A.S.), 10 fathoms off Del Monte, California. Length, 5.8 mm.; maximum diameter, 1.6 mm.; p. 222.

Fig. 11. *Retusa (Sulcularia) montereyensis* Smith and Gordon. Holotype No. 8527 (C.A.S.), 25 fathoms off Cabrillo Point, Monterey Bay, California. Length, 2.8 mm.; maximum diameter, 1.1 mm.; p. 217.

Fig. 12. *Odostomia (Menestho) churchi* Smith and Gordon. Holotype No. 8544 (C.A.S.), 25 fathoms off Cabrillo Point, Monterey Bay, California. Length, 1.8 mm.; maximum diameter, 0.5 mm.; p. 224.

Fig. 13. *Turbonilla (Bartschella) bartschi* Smith and Gordon. Holotype No. 8542 (C.A.S.), 25 fathoms off Cabrillo Point, Monterey Bay, California. Length, 2.0 mm.; maximum diameter, 0.7 mm.; p. 222.

Fig. 14. *Odostomia (Salassiella) heathi* Smith and Gordon. Holotype No. 8543 (C.A.S.), 15 fathoms off Cabrillo Point, Monterey Bay, California. Length, 2.8 mm.; maximum diameter, 1.0 mm.; p. 223.

Fig. 15. *Rissoella herleini* Smith and Gordon. Holotype No. 8545 (C.A.S.), 10 fathoms off Cabrillo Point, Monterey Bay, California. Length, 2.2 mm.; maximum diameter, 1.5 mm.; p. 224.



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